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Agricultural Finance Review

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A Prospect for the Eighties

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Agricultural Finance Review. National Economics Division, Economics and Statistics Service, U.S. Department of Agriculture. Volume 41.

In This Issue: Prospects for the Eighties

In this issue of *Agricultural Finance Review*, several specialists in agricultural finance offer their insights into the financial needs of the farming sector in the eighties and how these needs will be met. From their varied backgrounds and affiliations, the authors present their best assessments of the probable future events that will affect financing of U.S. agriculture. One of our aims in compiling this special issue was to provide information critical to the debate over the future of farm credit programs in the 1981 farm bill.

Preface

Agricultural Finance Review is an annual publication of the Economics and Statistics Service. The Review usually consists of contributed articles. In some years, however, articles are commissioned from specific authors to deal with topics of current interest. Articles report on the concepts and research in a broad range of agricultural finance issues that relate to farm and rural finance, financial management and firm growth strategies, insurance, income, processing and distribution industries, financial institutions, taxation, rural economic development, and the organization of agricultural production. The current volume was compiled by David A. Lins, Dean W. Hughes, and Stephen C. Gabriel.

The purpose of this Review is to provide a forum for the presentation of agricultural finance research. Articles are intended to stimulate thought and open communication among researchers and to present research results related to problems in agricultural finance.

Articles for the next Review are welcomed. Manuscripts and correspondence relating to the Review should be sent to David A. Lins, Economics and Statistics Service, 305 Mumford Hall, University of Illinois, Urbana, Ill. 61801, or to Stephen C. Gabriel, Economics and Statistics Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Articles may be quoted, reprinted, or abstracted without authorization, but citation is appreciated. Comments from readers are welcomed.

Conclusions and viewpoints published in this report do not necessarily reflect the views or policies of the U.S. Department of Agriculture. Reference to commercial firms, trade products, or company names is for identification only and does not imply endorsement by the U.S. Department of Agriculture.

Washington, D.C. 20250 July 1981

n Overview of Farm Sector Capital and redit Needs

Dean W. Hughes*

Abstract

Farmers' financial condition in the eighties will be determined primarily by Government fiscal and monetary policies. Net farm income and farmers' wealth may increase substantially if inflation can be controlled and steady growth in real output sustained. If, however, the general economy suffers from high inflation and slow-to-negative growth in output, farmers will probably face financial difficulties by the end of the decade. Farm debt will likely increase to about $500 billion by the end of the decade with a healthy general economy; it may rise to almost $1 trillion under poor economic conditions.

Keywords: Farm debt, Farm credit, Inflation, Farm financial conditions

roduction

m assets grew from $315 billion in 1970 to over trillion in 1980. What will they be in 1990? And, will farmers finance the purchases of those ets? These questions must be addressed when assess farmers' debt needs and the Government's role in farm credit markets.

this article, I have provided an overview of the ely capital requirements of the U.S. farm sector the eighties. Included are forecasts of the likely els of these needs and the portions that will bably be met by using internal (equity) versus ernal (debt) financing.[1]

jections of current trends, such as those in the lowing sections, should be viewed with caution, cause of current economic uncertainties as well several fundamental changes in Government icies over the last year. New sets of regulations re recently enacted for the banking system, and endments to the 1971 Farm Credit Act were cently passed. Government lending grew from 6 percent of all farm debt outstanding in 1975 to 14 percent in 1980. How the Government will cope with inflation is as yet unresolved. Although the Federal Reserve System has stated that its goal is to control growth in the money supply, the money supply (M1A) grew at an annual rate of over 14 percent from June to October 1980. Three Government budgets were considered during the last 6 months of 1980. Point estimates of the future are, therefore, nearly meaningless. However, by providing projections for a range of likely outcomes, we can show the role of Government programs designed to react to economic crises. The four different forecasts presented in this article illustrate the sensitivity of farm credit needs to Government decisions. The baseline projections, or "most likely" set of results, are discussed in detail. Summaries of the results of alternative scenarios are also included and compared with the baseline projections to develop distinctly different conclusions.

Background

U.S. agricultural production has gone through many changes in the last three decades, all of which have affected the indicators of farm sector financial well-being *(5, 10)*.[2] Among these changes are the following:

The author, formerly an agricultural economist with the onomics and Statistics Service, U.S. Department of riculture, is a staff economist with the Federal Reserve Bank Kansas City. He thanks Stephen Gabriel, Ronald Meekhof, and o anonymous reviewers for their helpful comments and suggesns.

Other sources of external capital are available such as leasing. ck of historical data on the use of these sources of capital ecludes empirically forecasting their importance in the future. e articles by Boehlje and by Penson and Duncan in this issue of Review for further discussion of the alternatives to debt ancing.

[2] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

- Mechanization of crop production and increased livestock confinement feeding have greatly reduced the need for farm labor, have increased the capital requirements of farmers, and have made farmers dependent on petroleum products and other nonfarm produced inputs.

- Increased agricultural exports and Government programs have led to increased returns to fixed factors of production, primarily owner labor, management skills, and land—and have generated real increases in the costs of these inputs *(6)*.

- Larger fixed costs and greater dependence on the vagaries of international trade have made net returns before Government payments increasingly unstable. These increases in the risks of farming have affected the growth and sources of farm debt. Without Government intervention, growth in farm debt should be slowed by increases in business risk *(1)*. Yet the Federal Government has reacted to farmers' distress during poor income years by providing additional credit. Although the total effects of changes in risk on the level of farm debt are not clear, the shift to Government lenders is evident from recent USDA publications *(11)*.

- There has been a movement to fewer and larger farms. As farmers leave the sector, they take with them the wealth that they accumulated during their tenure. Fewer individuals are then left to purchase the resources that are farm specific. This has led to increased capital requirements for the remaining participants, in some cases exceeding an individual's possible lifetime savings. With increased per farm capital requirements, sector debt has risen dramatically, becoming a permanent fixture in the balance sheets of many farmers. Increased debt use has removed part of the farm environment's traditional insulation from the rest of the economy.

- Farmers have become more commercialized, and the farm population is no longer self-sufficient. Home consumption of both crops and livestock has declined more rapidly than the number of people on farms. Farm families now go to the grocery store to purchase items that they themselves may have produced. Consumption expenditures have, therefore, become more rigid, reducing the ability of farmers to ride out the bad years by "tightening their belts."

Each of the above changes suggests the farm sect is now, and will continue to be, a much more integrated part of the U.S. and world economies. Thus, any attempt to project the future of the far sector through the eighties must address a much broader range of issues than would have been required in past decades.

Methodology and Assumptions

Brief discussions of the model and the assumption used in generating forecasts of farm financial situa tions are included in the following two sections.

Model Description

A computer simulation program designed to forecast the most likely consequences of public policy decisions on the indicators of the economic well-being of domestic producers of food and natural fibers was used for this article *(2)*. The model, called GEM, includes supply and demand functions for all goods in the national economy using a general equilibrium theoretical structure. It simultaneously provides forecasts of many commo macroeconomic variables, but it focuses specificall on the farm sector. Recent literature *(3, 8)* points t several linkages between farm production and oth economic sectors including: (1) farm input markets (2) markets for farm products, (3) impacts of agric tural and nonagricultural imports and exports on domestic markets, (4) effects of general economic conditions on off-farm employment opportunities f farm operator families, and (5) influences of gener economic conditions on the quantity and cost of farm debt. The model used in this study captures all these connections.

As with all simulation models, this model require forecasts of exogenous information. These variabl include: (1) Government policy—fiscal policy, mon tary policy, an import quota on livestock, target prices, loan rates, and others; (2) population—far U.S., and the rest of the world; and (3) non-U.S. economic conditions—foreign industrial productio index, the price of imported fuel, and zero-one du mies for the Organization of Petroleum Exporting Countries (OPEC) cartel and for the conversion t floating exchange rates. Once specified, the mode

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Inflationary Impacts and the GEM Model

Contrary to most explanations suggested in agricultural economics literature *(4, 6, 9)*, a decline in net farm income is not caused by some inexplicable negative correlation between net farm income and the inflation rate, nor by increases in the constant dollar prices of inputs sometimes confused with inflation. GEM solves all equations with constant dollar measures of prices and values—with the exception of some tax equations. Thus, the constant dollar prices of inputs and outputs are determined almost without regard to the inflation rate. Inflation has two major impacts on the model. First, it does reduce disposable income by increasing tax rates. Second, the Government is assumed to suffer from monetary illusion. Government budgets are exogenously specified in nominal terms, and then the endogenous calculation of the consumer price index determines Government's constant dollar contribution to the gross national product. Both these impacts reduce consumer demand for food if inflation is high. These reductions are not, however, specific to agriculture. In fact, it is likely that other sectors of the economy, such as housing and automobile construction, are bigger losers than agriculture when inflation rapidly rises.

enerates reports, including: (a) a list of relevant acroeconomic variables, (b) the balance sheet of e farm sector, (c) farm income statistics, and) the cash sources and uses of funds statement for e farm sector.[3]

ssumptions

posed four questions when deciding on the aseline and alternative scenarios developed in this rticle. Will the Government control monetary and scal policy so as to reduce inflation? Or, will inflaion continue at a double-digit rate?[4] Will policyakers react to continued loss of agricultural olitical power by reducing direct involvement in he farm sector? Or, will current programs be used nd perhaps increased?

ptimism guided the baseline scenario, which, herefore, assumes that a combination of monetary nd fiscal policies will be implemented by the ederal Government to reduce inflation over the ext 10 years. For the baseline solutions, monetary rowth is held low and the Government deficit eclines from 1981-1990.

It is not clear whether an optimist would choose high or low Government involvement in agriculture. The choice is partially conditioned by philosophical leanings and by the implications of other, more general, assumptions about the farm sector. The baseline assumes that the constant dollar level of Government involvement in agriculture will be the same or slightly greater than today.

Three alternative scenarios were also developed. In the high-inflationary alternatives, the Federal Reserve System's discount rate is lower, the growth in money is substantially greater, and the Federal deficit, which is set to grow at 10 percent per year, is actually declining in real terms because the inflation rate is slightly higher than 10 percent. If the deficit were to grow in real terms, the model would generate constantly accelerating interest rates.

The first alternative keeps Government involvement constant, but it assumes monetary and fiscal policies that generate relatively high inflation rates throughout the eighties.

The second alternative keeps the inflation rate low, but reduces Government involvement in agriculture. Reduced Government involvement included reducing real payments to farm operator families, declining real target prices and loan rates, and reduced purchases of final agricultural products—through food stamps and other Government programs.

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[3] Other reports that can be generated are balance sheets for arm operator families, for other domestic consumers, for the nonarm production sector, a personal income and outlay account for ontinuing farm operator families, and a capital finance account or continuing farm operator families.

[4] Optimism is the rule in this article. Thus, a constantly increasng level of inflation is not considered. As will be seen, even llowing inflation to continue at a double-digit rate over the next 0 years implies either disaster for agriculture or continually inreasing Government subsidies.

The third alternative assumes high inflation and reduced Government involvement.

For all scenarios, populations were projected to grow at rates consistent with observations over the last 5 years. Exogenous variables relating to international economic conditions were the same in all projections. Average industrial production for non-U.S. industrialized nations was assumed to increase at 4 percent per year throughout the decade. Nominal prices of imported fuel were expected to rise by 10 percent each year. The continued existence of OPEC and floating exchange rates were assumed. And no weather variations were assumed; that is, average weather conditions in the 1956-78 period were imposed.

Baseline Projections

Table 1 presents the macroeconomic results of the assumptions made for the baseline scenario. The overall picture is one of rather poor economic health for 1980 and 1981, but with a strong recovery in 1982 and sustained real growth through the rest of the decade. Nominal interest rates decline early in the decade as inflation is brought under control. They start to increase again later in the decade as real rates of interest become increasingly positive. In the economy, these increases would create larger incentives for savings. Increased savings would then be translated into productive investments, given real growth through the rest of the decade.

Note that if higher real interest rates and lower inflation occur, the U.S. dollar would be strengthened. Although this would reduce the quantity of U.S. agricultural exports, increases in foreign population and incomes, coupled with expanding supplies of food for export from the United States, would more than compensate.[5] The baseline solution shows the quantity of U.S. agricultural exports increasing by 65 percent from 1979 to 1990, a growth rate of about 5 percent per year.

Farm Sector Projections

Tables 2 and 3 present the baseline projections of farm income for the next decade. The summary statistics in table 2 show low net farm incomes in the first part of the decade. During this time there is a slow increase in total receipts, but production expenses increase in line with the inflation rate. Later in the decade, assuming higher domestic consumer incomes, a lower inflation rate, and stable growth in exports, farm sector net income grows rapidly. A net farm income of $85 billion in 1990 represents a more than 230-percent nominal increase from the 1980 projected level of $25.3 billion. Even in constant dollar terms, farmers would do substantially better, with a 73-percent increase in constant dollar net income over the decade.

The balance sheet of the farming sector shows the impact of the previously described environment on farm assets and debts (table 4). In general, there are no major surprises. Farm assets, especially real estate, continue to increase. The value of farm real estate grows from the current level of $671 billion on January 1, 1980, to almost $3 trillion in 1990. In constant dollar terms, this is an increase of almost 100 percent in 11 years, equivalent to an average annual compound rate of 6.5 percentage points higher than inflation. Deposits at banks decline by the end of the decade. The costs of holding bank deposits, particularly demand deposits which pay no interest, would be high, reducing farmers' desire to hold them.[6]

Farm debt continues to grow throughout the decade, with the largest increases occurring in the early eighties when farm incomes are low. Debt is forecast to increase faster than the value of assets, generating an increasing debt-to-asset ratio until 1985. In the latter part of the decade, high real interest rates and good farm incomes reduce the demand for additional debt, and the debt-to-asset ratio falls.

The cash sources and uses of funds (CSUF) statement makes a clearer distinction than the balance sheet between internal and external financing (table 5). A CSUF statement provides an accounting of the dollars that flow into the sector and the purposes for which they are used. It includes off-farm income as a source of funds. Depreciation is not subtracted, but capital purchases in the current year are treated as a use of funds. The CSUF statement excludes unrealized capital gains as either a source or a use of cash. A measure of the money that farm

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[5] In the baseline solution, domestic prices of final agricultural goods are rising relative to prices of nonagricultural goods throughout the decade. Domestic food consumption is, therefore, less than if food prices declined, resulting in larger quantities of food available for export.

[6] Perhaps new legislation, changing the interest rates that banks can offer on deposits, would make this decline less likely. If deposits decline, rural banks will probably face challenges in finding funding for agricultural loans.

Table 1—Macroeconomic variables for the baseline scenario

Item	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
U.S. gross national product	Billion dollars	2,636.6	2,882.5	3,226.7	3,593.8	4,011.6	4,417.2	4,887.4	5,385.4	5,995.6	6,575.9	7,236.9
	Percent change	11.7	9.3	11.9	11.4	11.6	10.1	10.6	10.2	11.3	9.7	10.0
Consumer price index	Index 1967 = 100	246.7	269.2	290.6	312.4	340.2	370.1	397.3	423.6	457.6	494.9	529.5
	Percent change	13.5	9.1	8.0	7.5	8.9	8.8	7.3	6.6	8.0	8.2	6.8
U.S. disposable personal income	Billion dollars	1,822.2	1,992.1	2,230.4	2,484.6	2,773.7	3,054.3	3,379.9	3,724.8	4,147.2	4,548.7	5,006.6
	Percent change	15.5	9.3	12.0	11.4	11.6	10.1	10.7	10.2	11.3	9.7	10.1
Interest rate on short-term Government bonds	Percent	8.9	7.2	7.2	7.4	7.9	8.1	8.0	8.1	8.7	9.0	8.8
	Percent change	9.0	– 19.3	– .1	3.1	6.9	2.7	– 2.1	1.2	7.4	3.3	– 1.8
Interest rate on 3-5 year Government bonds	Percent	10.5	8.4	8.2	8.3	9.0	9.2	8.8	8.8	9.5	9.8	9.4
	Percent change	9.8	– 19.9	– 1.8	1.5	7.6	1.9	– 3.9	– .2	8.5	2.4	– 3.4
Interest rate on long-term Government bonds	Percent	9.9	8.0	7.9	8.1	8.7	8.9	8.6	8.6	9.4	9.6	9.3
	Percent change	9.0	– 19.1	– .8	2.1	7.1	2.2	– 3.1	.4	8.3	2.3	– 2.6
Prime interest rate	Percent	14.9	10.2	8.9	9.9	11.4	11.5	10.3	10.1	12.0	12.9	12.2
	Percent change	18.5	– 31.6	– 12.3	11.5	14.6	.9	– 10.5	– 2.2	18.9	7.7	– 5.5
Corporate profits	Billion dollars	143.9	171.6	192.9	217.9	243.2	267.3	300.9	334.6	370.6	403.6	450.6
	Percent change	15.0	19.2	12.4	13.0	11.6	9.9	12.6	11.2	10.8	8.9	11.6
U.S. dollar exchange rate	Index 1967 = 100	95.8	101.3	102.0	103.8	105.9	107.6	111.1	114.8	117.2	120.3	124.4
	Percent change	3.5	5.7	.7	1.8	2.0	1.6	3.3	3.3	2.1	2.7	3.4

participants withdraw for personal uses—consumption or investment in nonfarm assets—can therefore be obtained as a residual.

As has been true in the past, off-farm income will be important in financing farm activities. Although not shown in table 5, off-farm income is forecast to be approximately $51 billion in 1980 and $243 billion in 1990. These numbers represent 41 percent of cash sources of funds in 1980 and 63 percent in 1990. Additionally, off-farm income tends to smooth out some of the sharp declines in farm income shown in table 2. However, the constant dollar purchasing power of the money left over for consumption and nonfarm investments indicates that, until 1986, operator families are not likely to enjoy the standard of living they achieved in 1979.

Under the baseline scenario the proportion of cash needs supported by internally generated funds rather than debt rises throughout the decade. With a healthy overall economy, the resulting improvement in the current returns to farming, and higher real costs of borrowing, this forecast suggests that farmers can reverse the trend of the increasing importance of debt.

How Will Farms be Financed Under the Baseline Assumptions?

Farm debt is forecast to increase by more than $350 billion from January 1, 1980, to January 1, 1991—an increase of over 230 percent—even under the optimistic assumptions in the baseline projections. Yet, this debt load should not be too great in a healthy economy. Farm debt, at the half-trillion dollar mark, would be only 4.6 percent of total U.S. private debt, as contrasted with 5.5 percent in 1980. And interest expenses would be 10.4 percent of total production expenses in 1990 versus 12 percent in 1980.

Any financing problems that might exist would occur in the first half of the decade when farm incomes would be low and the debt-to-asset ratio would be increasing. In the early eighties several

Table 2—Summary of farm income for the baseline scenario

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	199
	Billion dollars[1]										
Realized gross farm income:											
Excluding Government payments	155.9	161.6	175.1	200.9	207.2	236.4	269.3	310.2	334.3	369.7	408.
Including Government payments	157.4	164.6	178.4	204.5	211.2	240.8	274.1	306.5	340.1	376.2	415.
Production expenses:											
Excluding Government payments	134.1	137.9	153.2	174.8	187.2	210.0	232.7	255.9	280.5	307.0	335.
Including Government payments	133.8	137.2	152.5	174.0	186.3	209.1	231.7	254.7	279.3	305.6	333.
Realized net farm income:											
Excluding Government payments	21.8	23.8	21.9	26.1	20.0	26.4	36.5	45.3	53.7	62.8	72
Including Government payments	23.6	27.4	25.9	30.5	24.9	31.7	42.4	51.8	60.8	70.6	81
Net change in farm inventories	1.7	.4	1.0	1.6	1.5	2.2	2.5	2.7	3.0	3.4	3
Total net farm income:											
Excluding Government payments	23.5	24.2	22.9	27.6	21.5	28.6	39.0	48.1	56.8	66.2	76
Including Government payments	25.3	27.8	26.9	32.0	26.3	33.9	44.9	54.5	63.8	73.9	85

[1] Numbers may not add due to rounding.

Table 3—Detailed report of farm income for the baseline scenario

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
						Billion dollars[1]					
Income											
Cash receipts from:											
Crop marketings	64.2	77.3	84.6	90.6	105.8	113.3	120.6	130.0	140.4	151.7	164.1
Livestock marketings	77.7	68.7	74.1	89.6	78.3	96.6	118.1	136.2	153.7	171.9	191.1
Total	141.9	145.9	157.2	180.2	184.0	209.9	238.7	266.2	294.1	323.6	355.1
Government payments	1.5	3.0	3.3	3.6	4.0	4.4	4.8	5.3	5.8	6.4	7.1
Total cash receipts	143.4	148.9	160.5	183.8	188.0	214.3	243.6	271.5	299.9	330.1	362.2
Nonmoney and other farm income:											
Household consumption of—											
Livestock	1.5	1.3	1.4	1.7	1.8	2.2	2.8	3.4	4.0	4.8	5.7
Crops	.6	.6	.6	.8	.8	1.0	1.3	1.5	1.8	2.2	2.6
Gross rental value of farm dwellings	9.6	11.0	12.7	14.5	16.5	18.8	21.4	24.4	28.0	32.2	37.1
Other farm income	2.4	2.8	3.2	3.6	4.1	4.6	5.1	5.7	6.3	6.9	7.6
Realized nonmoney and other farm income	14.0	15.7	17.9	20.7	23.2	26.6	30.5	35.0	40.2	46.1	53.1
Net change in farm inventories	1.7	.4	1.0	1.6	1.5	2.2	2.5	2.7	3.0	3.4	3.7
Total nonmoney and other farm income	15.8	16.1	18.9	22.2	24.7	28.7	33.0	37.8	43.2	49.5	56.8
Realized gross farm income:											
Excluding Government payments	155.9	161.6	175.1	200.9	207.2	236.4	269.3	301.2	334.3	369.8	408.2
Including Government payments	157.4	164.6	178.4	204.5	211.2	240.8	274.1	306.5	340.1	376.2	415.3
Total gross farm income:											
Excluding Government payments	157.7	162.0	176.0	202.4	208.7	238.6	271.8	303.9	337.3	373.1	411.9
Including Government payments	159.2	165.0	179.3	206.1	212.7	243.0	276.6	309.3	343.1	379.6	419.0

Continued—

See footnote at end of table.

Table 3—Detailed report of farm income for the baseline scenario—Continued

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Billion dollars[1]										
Expenses											
Current farm operating expenses:											
Feed purchased	17.7	21.4	23.9	28.7	28.7	32.0	33.7	36.1	39.6	43.9	48.8
Livestock purchased	13.7	11.1	11.6	15.7	13.6	17.5	22.5	27.0	31.6	36.3	41.4
Seed purchased	3.8	4.9	5.6	6.7	7.5	8.8	10.1	11.6	13.3	15.3	17.6
Fertilizer and lime purchased	10.0	11.5	13.0	14.6	16.4	18.3	20.3	22.5	24.8	27.2	29.9
Repairs and operation of capital items:											
Farm operator dwellings	.2	.2	.2	.2	.1	.1	0	0	0	0	0
Service buildings	1.6	1.8	2.2	2.9	3.7	4.8	6.5	8.9	12.5	17.8	25.5
Petroleum fuel and oil	9.1	6.6	7.6	8.3	9.1	10.0	10.9	11.8	12.7	13.6	14.7
Motor vehicles and machinery	5.6	6.3	6.9	7.5	8.1	8.6	9.1	9.5	9.8	9.9	9.9
Total	16.5	15.0	16.9	18.8	21.0	23.5	26.5	30.1	34.9	41.3	50.1
Hired labor:											
Farm resident workers	2.2	2.5	2.7	2.7	2.7	2.7	2.5	2.3	2.0	1.6	1.1
Other hired workers	5.8	6.5	7.0	7.3	7.4	7.7	7.0	6.4	5.3	3.7	1.6
Interest on nonreal estate debt	7.7	5.7	5.7	5.1	5.9	6.6	7.4	8.2	9.0	9.6	10.2
Other	15.4	15.7	17.3	19.8	21.1	23.7	26.2	28.8	31.6	34.7	38.0
Total current operating expenses	92.8	94.4	103.7	118.5	124.2	140.3	156.3	173.0	192.0	213.7	238.5
Depreciation and capital consumption:											
Farm operating dwellings	2.9	3.4	3.9	4.4	5.0	5.7	6.5	7.4	8.4	9.7	11.1
Service buildings	3.4	3.7	4.0	4.3	4.6	4.9	5.3	5.6	5.9	6.2	6.6
Machinery and motor vehicles	13.8	15.5	17.0	18.4	19.8	21.1	22.2	23.2	23.9	24.4	24.4
Accidental damage	.6	.7	.8	.8	.9	.9	1.0	1.1	1.1	1.2	1.2
Total	20.8	23.3	25.6	28.0	30.3	32.7	35.0	37.2	39.4	41.4	43.3
Taxes on farm properties	5.7	6.3	7.0	7.8	8.6	9.5	10.4	11.4	12.6	13.8	15.3
Interest on farm mortage debt	8.3	8.0	8.7	10.3	12.0	13.8	15.9	18.2	20.4	22.5	24.5
Net rent to nonoperator landlords:											
Excluding Government payments	6.5	5.8	8.1	10.2	12.0	13.7	15.2	16.0	16.2	15.5	13.9
Total	6.8	6.5	8.8	10.9	12.8	14.7	16.2	17.1	17.4	16.8	15.4
Total production expenses:											
Excluding Government payments	134.1	137.9	153.2	174.8	187.2	210.0	233.7	255.9	280.5	307.0	335.4
Including Government payments	133.8	137.2	152.5	174.0	186.3	209.1	231.7	254.7	279.3	305.6	333.9

[1] Numbers may not add due to rounding.

Table 4—Balance sheet of the farming sector for the baseline scenario

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Billion dollars[1]										
Assets											
Physical assets:											
Real estate	730.3	801.4	922.4	1,066.8	1,211.9	1,379.1	1,579.6	1,818.1	2,109.5	2,473.5	2,941.3
Nonreal estate:											
Livestock and poultry	59.6	51.4	51.3	62.2	55.8	68.0	83.5	97.9	112.9	129.2	147.2
Machinery and motor vehicles	105.8	119.2	130.5	141.7	152.3	162.0	170.6	177.9	183.2	186.2	185.8
Crops stored on and off farms	40.7	46.7	52.1	57.9	63.9	69.8	75.8	81.9	87.8	93.7	99.4
Household equipment and furnishings	22.6	25.8	28.0	30.3	32.8	35.4	38.0	40.8	44.0	47.6	51.9
Financial assets:											
Deposits and currency	15.8	16.0	16.4	16.6	16.5	16.5	16.4	15.6	13.9	10.7	5.3
U.S. savings bonds and investments in cooperatives	26.9	29.6	32.0	34.7	37.4	40.4	43.9	47.7	51.9	56.6	61.8
Total	1,001.7	1,090.0	1,232.7	1,410.0	1,570.6	1,771.4	2,007.7	2,280.0	2,603.2	2,997.5	3,492.8
Claims											
Liabilities:											
Real estate debt	95.9	108.8	122.5	139.2	157.0	176.8	198.1	219.7	240.1	258.0	271.9
Nonreal estate debt[2]	89.1	100.1	113.5	130.9	146.1	164.3	183.1	201.1	218.4	234.0	251.3
Total liabilities	184.9	208.9	235.9	270.1	303.2	341.1	381.2	420.7	458.5	493.0	523.2
Proprietors' equity	816.7	881.2	996.7	1,140.1	1,267.4	1,430.3	1,626.5	1,859.2	2,144.7	2,504.4	2,969.6
Total	1,001.7	1,090.0	1,232.7	1,410.2	1,570.6	1,771.4	2,007.7	2,280.0	2,603.2	2,997.5	3,492.8
	Percent										
Debt/assets	18.5	19.2	19.1	19.2	19.3	19.3	19.0	18.5	17.6	16.4	15.0

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[1] Numbers may not add due to rounding.
[2] Includes Commodity Credit Corporation debt.

Table 5—Cash sources and uses of funds for the farming sector, baseline scenario

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
						Billion dollars[1]					
Cash Sources of Funds[2]											
Net cash income from farm and nonfarm sources[3]	93.1	98.8	109.7	128.3	136.3	160.2	192.1	226.6	265.3	310.3	363.0
Net flow of real estate loans	13.8	12.9	13.7	16.7	17.8	19.7	21.3	21.6	20.4	17.9	13.9
Net flow of nonreal estate loans[4]	16.0	12.0	12.7	16.1	15.0	16.2	15.8	14.2	12.2	9.9	7.4
Total cash sources of funds	122.9	123.8	136.1	161.1	169.0	196.1	229.3	262.3	297.9	338.0	384.3
Cash Uses of Funds											
Purchases of machinery and motor vehicles	11.1	14.3	15.2	16.0	16.6	17.3	17.7	18.0	17.8	17.4	16.4
Capital improvement to real estate assets	17.5	19.8	23.7	28.1	31.9	37.9	46.0	56.1	70.1	89.0	115.5
Other capital purchases[5]	4.1	5.3	6.0	7.0	6.5	7.8	9.5	10.6	11.5	12.2	12.6
Annual capital formation	32.7	39.4	44.9	51.1	55.0	63.1	73.1	84.6	99.4	118.7	144.6
Purchases of real estate from discontinuing proprietors	13.2	16.2	18.8	22.0	25.2	28.9	33.3	38.7	45.2	53.5	64.2
Total purchased capital	45.9	55.6	63.8	73.1	80.2	91.9	106.4	123.3	144.6	172.2	208.7
Personal consumption and other cash uses	77.0	68.2	72.4	88.0	88.8	104.2	122.9	139.0	153.3	165.9	175.5
Total cash uses of funds	122.9	123.8	136.1	161.1	169.0	196.1	229.3	262.3	297.9	338.0	384.3
Total purchased capital	45.9	55.6	63.8	73.1	80.2	91.9	106.4	123.3	144.6	172.2	208.7
Change in inventories	1.7	0.4	1.0	1.6	1.5	2.2	2.5	2.7	3.0	3.4	3.7
Total capital flow	47.6	55.9	64.7	74.7	81.7	94.1	108.9	126.1	147.6	175.5	212.4
Real dollar flows											
Total net cash income/CPI	37.7	36.3	37.4	40.7	40.3	44.4	50.1	55.7	61.6	68.3	75.8
Personal consumption and other cash uses/CPI	31.2	25.1	24.7	27.9	26.3	28.9	32.0	34.2	35.6	36.5	36.7
						Percent					
Analytical Ratios											
Total purchased capital/total net cash income	49.3	56.2	58.1	57.0	58.9	57.4	55.4	54.4	54.5	55.5	57.5
Total net flow of loans/total purchased capital	64.9	44.9	41.4	44.9	40.9	39.1	34.9	29.0	22.6	16.1	10.2
Total net flow of loans/total capital flow	62.5	44.6	40.8	43.9	40.1	38.2	34.1	28.4	22.1	15.8	10.0
Net flow of real estate loans/total cash uses	11.2	10.4	10.0	10.4	10.5	10.1	9.3	8.2	6.9	5.3	3.6
Cash income/total cash uses	75.8	79.9	80.6	79.6	80.6	81.7	83.8	86.4	89.1	91.8	94.5
End of year debt outstanding/total cash income	198.6	211.3	215.0	210.5	222.5	213.0	198.4	185.7	172.8	158.9	144.1

[1] Numbers may not add due to rounding. [2] Cash sources of funds from sale of real estate to the nonfarm sector are not included due to lack of data. [3] Does not include labor perquisites in calculation of production expenses before subtracting from gross cash income. [4] Does not include Commodity Credit Corporation loans. [5] Includes net additions to household furnishings, commercial bank deposits and currency, savings bonds, equity in farmer cooperatives, and purchases of breeding livestock.

pes of farmers will likely have recurring difulties obtaining preferred levels of debt. Liveck producers are forecast to be in the most trou-, increasing herds at a time when production ts are rising rapidly. Low-equity farmers, includ- farmers just getting started, will have difficulty paying loans over the first half of the decade ile nominal interest rates are high and current urns are low. New farmers with outside income rces might find 1982 and 1983 excellent years to started if inflation is brought under control. rger farms, which historically have not had a ge share of off-farm income, will have gone ough 2 financially difficult years and thus might be in the land market as purchasers. With the spects of higher rates of appreciation in real ate and higher current returns, a farmer who rts in 1982-83 might be in good financial health the end of the decade.

ternative Scenarios

ree alternatives to the baseline projections were to show the impacts of different Government cal, monetary, and farm policies on farmers' ancial conditions. The alternatives include high lation-high Government involvement (HI-HG), low lation-low Government involvement (LI-LG), and h inflation-low Government involvement (HI-LG). contrast to the baseline projections, the highlation scenarios show Government expenditures d the Government deficit growing faster than intion. And each additional dollar of deficit spend- is assumed to be financed by the Federal serve System's printing an extra dollar bill. wer Government-involvement scenarios are genated by keeping support prices lower than in the seline and maintaining corresponding reductions the purchases of agricultural products at the m level. Government purchases of food for hool Lunch and Food Stamp programs are also s for the low Government-involvement scenarios an they are in the baseline scenario.

acroeconomic Variables

ble 6 presents a shortened list of important acroeconomic variables for each of the three altertive scenarios. As one would expect, the variaons in Government involvement in the farm sector ve only small impacts on the overall economy. owever, comparisons of the macroeconomic results r the high-inflation and low-inflation scenarios are teresting. In the baseline solution, which had declining inflation, the only forecasted recession was in 1980-81. With easier monetary and fiscal policies, the economy might also start to decline in real terms in 1987. If inflation continues, the recovery is weaker in 1982, and the sustained growth in real GNP presented in the baseline solution never develops. Nominal interest rates are higher in every year in the high-inflation results. Yet, by the latter part of the decade, the baseline interest rates are projected to be higher in real terms.

Farm Income

Net farm income is dramatically affected by the different assumptions made in the alternative scenarios (table 7). In both high-inflation forecasts, net farm income is decidedly lower than when inflation is controlled. The size of Government involvement in agriculture is far more critical if other Government policies are not developed to promote a healthy overall economy over the next decade. It is likely that the Federal Government would eventually become more involved than even the HI-HG scenario would suggest if farm income deteriorates as drastically as either the HI-HG or HI-LG scenarios project.

In the first half of the decade, none of the scenarios differs greatly in nominal terms. However, if inflation is not controlled as in the HI-HG and HI-LG projections, net farm incomes would continually decline throughout the eighties in constant dollar terms. Once inflation increases, tax rates start to accelerate and constant dollar gross national product declines. This decline reduces consumers' incomes and holds down food expenditures and farmers' gross receipts. Since production costs continue to rise at a rate approximately equal to inflation, net farm incomes in both nominal and real terms decline to almost nothing in the last half of the decade.

The Balance Sheet

Table 8 presents the results of forecasting the balance sheet of the farming sector for the three alternative scenarios. One of the most surprising results is the consistency of the value of total farm assets despite the differing macroeconomic and farm income results. However, although the nominal values of total assets are similar across scenarios, the composition of these assets differs radically. Note that in either of the *low-inflation*

Table 6—Selected macroeconomic variables for alternative scenarios

Item	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
High inflation and high Government involvement:												
U.S. gross national product	Billion dollars	2,636.6	2,818.0	3,167.7	3,539.5	3,910.4	4,352.0	4,844.0	5,401.8	6,018.6	6,706.6	7,480.7
	Percent change	11.7	6.9	12.4	11.7	10.5	11.3	11.3	11.5	11.4	11.4	11.5
Consumer price index	Index 1967 = 100	246.7	271.9	297.6	328.3	363.9	403.5	449.6	503.3	567.0	642.7	733.7
	Percent change	13.5	10.2	9.4	10.3	10.8	10.9	11.4	12.0	12.6	13.4	14.2
Prime interest rate	Percent	14.9	11.6	10.4	12.5	12.9	12.9	13.4	14.1	14.9	15.8	16.8
	Percent change	18.5	– 21.8	– 10.6	19.9	3.7	– .5	4.2	5.0	6.1	5.9	5.9
Low inflation and low Government involvement:												
U.S. gross national product	Billion dollars	2,636.6	2,817.4	3,210.2	3,631.3	4,064.8	4,540.1	5,050.8	5,595.0	6,174.4	6,788.0	7,434.3
	Percent change	11.7	6.9	13.9	13.1	11.9	11.7	11.2	10.8	10.4	9.9	9.5
Consumer price index	Index 1967 = 100	246.7	271.9	293.3	315.4	338.0	360.5	383.2	406.2	429.5	453.1	476.7
	Percent change	13.5	10.2	7.8	7.5	7.2	6.6	6.3	6.0	5.7	5.5	5.2
Prime interest rate	Percent	14.9	11.6	8.8	9.6	9.3	8.8	8.8	9.0	9.4	9.8	10.4
	Percent change	18.5	– 21.8	– 24.6	9.9	– 3.5	– 5.1	– .4	2.3	3.8	4.9	5.6
High inflation and low Government involvement:												
U.S. gross national product	Billion dollars	2,636.6	2,817.4	3,165.7	3,534.5	3,914.1	4,352.7	4,842.2	5,393.1	6,006.2	6,693.2	7,402.3
	Percent change	11.7	6.9	12.4	11.7	10.7	11.2	11.2	11.4	11.4	11.4	10.6
Consumer price Index	Index 1967 = 100	246.7	271.9	297.6	328.2	363.6	403.5	449.5	503.3	566.6	642.1	732.8
	Percent change	13.5	10.2	9.4	10.3	10.8	11.0	11.4	12.0	12.6	13.3	14.1
Prime interest rate	Percent	14.9	11.6	10.4	12.5	12.9	12.9	13.4	14.1	14.9	15.8	16.9
	Percent change	18.5	– 21.8	– 10.6	19.8	3.2	.4	3.9	5.0	5.9	5.9	6.7

Table 7—Summary of farm income for alternative scenarios

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
						Billion dollars[1]					
High inflation and high Government involvement:											
Realized gross farm income	157.4	164.6	179.4	206.9	203.6	238.4	270.6	319.8	365.0	410.6	463.9
Production expenses	133.8	137.2	154.5	178.4	191.5	222.0	251.0	289.8	333.6	387.0	451.6
Realized net farm income	23.6	27.4	24.9	28.5	12.2	16.4	19.6	30.0	31.4	23.6	12.3
Net change in farm inventories	1.7	.4	.9	1.4	.9	1.8	1.8	2.3	2.3	2.5	2.7
Total net farm income:											
Excluding Government payments	23.5	24.2	21.8	25.5	8.3	12.9	15.6	25.9	26.6	18.3	6.4
Including Government payments	25.3	27.8	25.8	29.9	13.1	18.2	21.5	32.3	33.7	26.1	15.0
Low inflation and low Government involvement:											
Realized gross farm income	157.4	164.1	177.7	202.8	212.5	240.0	271.4	301.9	334.1	368.7	406.2
Production expenses	133.8	137.6	153.0	174.6	188.0	210.7	233.6	256.8	281.6	308.2	336.7
Realized net farm income	23.6	26.5	24.8	28.3	24.5	29.3	37.8	45.1	52.5	60.6	69.5
Net change in farm inventories	1.7	.2	.6	1.1	.9	1.5	1.8	1.9	2.2	2.4	2.7
Total net farm income:											
Excluding Government payments	23.5	24.5	23.2	27.1	23.1	28.4	37.0	44.4	51.9	60.1	69.2
Including Government payments	25.3	26.6	25.4	29.3	25.4	30.8	39.5	47.0	54.7	63.0	72.2
High inflation and low Government involvement:											
Realized gross farm income	157.4	164.1	178.8	205.2	215.5	246.4	277.2	318.7	362.3	409.2	463.7
Production expenses	133.8	137.6	154.9	178.9	195.8	225.2	256.2	295.2	340.7	396.2	462.5
Realized net farm income	23.6	26.5	23.9	26.3	19.7	21.2	20.9	23.5	21.6	13.0	1.2
Net change in farm inventories	1.7	.2	.5	.9	.6	1.1	1.2	1.5	1.7	1.9	2.0
Total net farm income:											
Excluding Government payments	23.5	24.5	22.2	24.9	18.0	19.8	19.6	22.4	20.5	12.1	.2
Including Government payments	25.3	26.6	24.4	27.2	20.3	22.3	22.1	25.0	23.3	14.9	3.2

[1] Numbers may not add due to rounding.

Table 8—Balance sheet of the farming sector for alternative scenarios

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
						Billion dollars[1]					
High inflation and high Government involvement:											
Assets											
Physical assets:											
Real estate	730.3	801.4	913.0	1,041.1	1,167.7	1,316.0	1,497.9	1,709.5	1,967.6	2,274.4	2,650.1
Nonreal estate	228.7	243.1	265.0	300.9	313.9	357.7	403.6	465.7	530.1	599.3	680.9
Financial assets	42.7	45.6	48.8	52.5	56.2	51.5	68.4	77.7	89.0	102.9	120.0
Total	1,001.7	1,090.0	1,226.7	1,394.5	1,537.9	1,735.3	1,969.9	2,252.9	2,586.8	2,976.6	3,451.0
Claims											
Liabilities:											
Real estate debt	95.9	108.8	123.6	143.0	165.4	193.6	229.4	274.4	330.4	400.4	488.6
Nonreal estate debt[2]	89.0	100.1	115.0	135.3	155.4	183.0	215.3	253.5	298.2	351.8	416.7
Total liabilities	184.9	208.9	238.6	278.3	320.8	376.6	444.7	527.9	628.6	752.2	905.3
Proprietors' equity	816.7	881.2	988.1	1,116.2	1,217.1	1,358.7	1,525.3	1,725.0	1,958.2	2,224.4	2,545.7
Total	1,001.7	1,090.0	1,226.7	1,394.5	1,537.9	1,735.3	1,969.9	2,252.9	2,586.8	2,976.6	3,451.0
						Percent					
Debt/asset ratio	18.5	19.2	19.5	20.0	20.9	21.7	22.6	23.4	24.3	25.3	26.2
						Billion Dollars[1]					
Low inflation and low Government involvement:											
Assets											
Physical assets:											
Real estate	730.3	801.0	921.9	1,065.8	1,211.0	1,378.0	1,577.8	1,816.1	2,107.0	2,470.7	2,938.5
Nonreal estate	228.7	242.7	259.5	346.1	297.4	322.6	349.3	373.0	395.2	416.0	434.7
Financial assets	42.7	45.5	48.3	51.2	53.9	57.0	60.3	63.4	66.2	68.2	68.7
Total	1,001.7	1,089.3	1,229.7	1,403.3	1,562.3	1,757.5	1,987.3	2,252.5	2,568.4	2,954.8	3,441.9
Claims											
Liabilities:											
Real estate debt	95.9	108.9	122.7	139.6	157.9	178.2	200.2	222.7	244.6	264.5	281.2
Nonreal estate debt[2]	89.0	99.9	113.1	130.3	145.6	163.5	170.8	199.6	216.8	233.5	249.8
Total liabilities	184.9	208.8	235.8	269.8	303.5	341.6	382.0	422.3	461.4	498.1	531.0
Proprietors' equity	816.7	880.5	993.9	1,133.4	1,258.8	1,415.9	1,605.3	1,830.2	2,107.0	2,456.8	2,910.9
Total	1,001.7	1,089.3	1,229.7	1,403.3	1,562.3	1,757.5	1,987.3	2,252.5	2,568.4	2,954.8	3,441.9
						Percent					
Debt/asset ratio	18.5	19.2	19.2	19.2	19.4	19.4	19.2	18.7	18.0	16.9	15.4

See footnote at end of table.

Continued—

Table 8—Balance sheet of the farming sector for alternative scenarios—Continued

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
						Billion dollars[1]					
High inflation and low Government involvement:											
Assets											
Physical assets:											
Real estate	730.3	801.0	912.7	1,040.0	1,169.4	1,320.4	1,506.0	1,728.0	1,933.5	2,308.0	2,607.2
Nonreal estate	228.7	246.4	262.6	294.8	313.5	351.3	391.3	442.5	498.8	561.7	634.2
Financial assets	42.7	45.5	48.7	52.4	56.6	62.0	68.9	77.8	88.9	102.7	120.6
Total	1,001.7	1,089.3	1,223.9	1,387.3	1,539.4	1,733.8	1,966.2	2,248.3	2,581.3	2,972.4	3,362.0
Claims											
Liabilities:											
Real estate debt	95.9	108.9	123.8	143.4	166.6	195.5	231.6	277.2	334.7	407.8	500.8
Nonreal estate debt[2]	89.0	99.9	114.7	134.6	155.3	181.9	213.6	251.8	297.5	353.5	418.2
Total liabilities	184.9	208.8	238.5	278.0	321.9	377.4	445.2	529.0	632.2	761.3	919.0
Proprietors' equity	816.7	880.5	985.4	1,109.2	1,217.5	1,356.5	1,521.0	1,719.3	1,949.0	2,211.0	2,443.0
Total	1,001.7	1,089.3	1,223.9	1,387.3	1,539.4	1,733.8	1,966.2	2,248.3	2,581.3	2,972.4	3,362.0
						Percent					
Debt/asset ratio	18.5	19.2	19.5	20.0	20.9	21.8	22.6	23.5	24.5	25.6	27.3

[1] Numbers may not add due to rounding.

[2] Cash sources of funds from sale of real estate to the nonfarm sector are not included due to lack of data.

scenarios, nominal farm real estate values are *higher* by 1990. At first, these results seem contradictory. Yet, the reasons for this are not difficult to understand. The value of farm real estate represents the capitalized value of expected future farm income streams *(7)*. Given that both the HI-HG and HI-LG scenarios are associated with continued long-term declines in the current real returns to farming, it is not difficult to accept lower constant dollar values of farm real estate. The fact that nominal farm real estate values are actually higher with lower inflation only reflects the magnitudes of the differences between net farm incomes and inflation rates in the different scenarios.

The composition of nonreal estate assets is also interesting. Financial assets are a far greater part of the asset mix if inflation is high. This trend represents two separate influences. If production expenses are higher in nominal terms, increased financial assets are required to meet transaction demands. Additionally, with farm investment showing reduced returns, farmers will likely shift their resources into nonfarm assets to seek more profitable uses for their wealth.[7]

Although farm asset values are relatively stable across scenarios, the same cannot be said for debt. Continued high inflation, low real interest rates, and poor net farm incomes result in nearly $1 trillion in farm debt by the end of the decade, approximately double farmers' debt if inflation is controlled. This would boost farm debt from approximately 5 percent of national private bank debt in 1980 to over 10 percent in 1990, which would represent a 65-percent increase in farm debt in constant dollars. Yet, the growth of farm debt to $1 trillion by the end of the decade represents an average annual increase of 17 percent, which is only slightly higher than the 15-percent average increase that has occurred in the last 3 years. The HI-HG and HI LG scenarios also show that farmers' equity positions would be worse if inflation continues unabated. In fact, both of these scenarios show increases in constant dollar farm debt being collateralized with decreased constant dollar farm equities. Instead of the declining debt-to-asset ratios found in the baseline and LI-LG scenarios, the HI-HG and HI-LG scenarios show farmers leveraging themselves more than at any time in the history of USDA statistics *(11)*.

Government farm policies could mitigate the severe problems that farmers will likely face if the general economy were poorly managed. Yet, without substantially increasing constant dollar payments to farmers, USDA cannot completely offset problems caused by other policymakers. To have constant dollar net farm incomes after Government payments equal in the baseline and HI-HG cases, cumulative payments of over $125 billion 1979 dollars would be required. It is highly unlikely that such payments would be made, as this would represent more in constant dollars than Government has paid to farmers over the last four decades. Even if this did occur, farmers faced with lower real interest expenses and a virtually risk free income would likely increase their debt by substantially more than is shown in the baseline projection.

Cash Sources and Uses of Funds Statement

To conserve space, table 9 includes only the cash sources and uses of funds statement for the HI-HG scenario. A comparison of tables 5 and 9 shows more clearly than other accounting statements the different impacts on farmers of a healthy macroeconomy and of one that continues to be plagued by high inflation and low real growth. Table 9 shows that the annual purchases of farm capital inputs would exceed total cash income—which includes off-farm income—by 1990. Farmers, therefore, would be forced to increase their debt borrowing. In constant dollar terms, the funds available for farm operator families' consumption expenditures and off-farm investments decline by over one-third if inflation is not controlled. Loans account for almost 80 percent of the total capital flow in 1990 as opposed to about 60 percent in 1980. There is likely to be a substantial increase in real estate-secured lending as current incomes can no longer sustain repayment of nonreal estate loans. Cash income covers only 54 percent of total cash uses in 1990 in contrast to over 75 percent in 1980. Finally, the 1990 ratio of debt outstanding to total cash income (table 9) suggests that even if every dollar of cash which farmers received—after production expenses—were used to retire debt, it would take almost 5 years to reduce debt to zero. This compares with less than 2 years in 1980 and with about 18 months in 1990, if inflation is controlled.

How Will Farms be Financed Under the Alternative Scenarios?

There is little difference between the high and low Government involvement scenarios—if inflation is

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[7] Note that these financial assets are the only nonfarm investment alternatives included in the balance sheet of the farming sector.

Table 9—Cash sources and uses of funds: High inflation and high Government involvement

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
						Billion dollars[1]					
Cash sources of funds[2]											
Net cash income from farm and nonfarm sources[3]	93.1	98.8	105.6	118.5	108.7	122.5	136.8	160.8	176.6	183.8	188.5
Net flow of real estate loans	13.8	12.9	14.8	19.3	22.4	28.3	35.8	45.0	56.0	70.0	88.2
Net flow of nonreal estate loans[4]	16.0	12.0	14.8	20.1	22.0	28.3	33.3	39.3	46.6	57.1	69.6
Total cash sources of funds	122.9	123.8	135.1	158.0	153.1	179.0	205.9	245.0	279.2	310.9	346.3
Cash uses of funds											
Purchases of machinery and motor vehicles	11.1	14.3	15.1	16.3	17.7	19.7	22.1	24.4	27.6	31.0	35.0
Capital improvement to real estate assets	17.5	19.8	23.4	27.1	30.5	35.5	42.3	49.5	59.3	70.6	84.7
Other capital purchases[5]	4.1	5.3	6.3	7.6	6.4	8.4	10.5	13.8	16.6	19.2	22.5
Annual capital formation	32.7	39.4	44.9	51.0	54.6	63.6	75.0	87.7	103.4	120.7	142.2
Purchases of real estate from discontinuing proprietors											
Total purchased capital											
Personal consumption and other cash uses	77.0	68.2	71.7	85.7	74.6	88.4	100.1	122.1	135.1	143.0	149.0
Total cash uses of funds	122.9	123.8	135.1	158.0	153.1	179.0	205.9	245.0	279.2	310.9	346.3
Total purchased capital	45.9	55.6	63.4	72.3	78.5	90.6	105.8	123.0	144.1	167.9	197.3
Change in inventories	1.7	0.4	0.9	1.4	0.9	1.8	1.8	2.3	2.3	2.5	2.7
Total capital flow	47.6	55.9	64.3	73.6	79.4	92.4	107.6	125.3	146.4	170.3	200.0
Real dollar flows											
Total net cash income/CPI	37.7	36.3	35.5	36.1	29.9	30.3	30.4	31.9	31.2	28.6	25.7
Personal consumption and other cash uses/CPI	31.2	25.1	24.1	26.1	20.5	21.9	22.3	24.3	23.8	22.3	20.3
						Percent					
Analytical ratios											
Total purchased capital/total net cash income	49.3	56.2	60.1	61.0	72.2	74.0	77.3	76.5	81.6	91.3	104.6
Total net flow of loans/total purchased capital	64.9	44.9	46.7	54.6	56.6	62.4	65.3	68.5	71.2	75.7	80.0
Total net flow of loans/total capital flow	62.5	44.9	46.0	53.6	55.9	61.2	64.2	67.2	70.1	74.6	78.9
Net flow of real estate loans/ total cash uses	11.2	10.4	11.0	12.2	14.6	15.8	17.4	18.4	20.1	22.5	25.5
Cash income/total cash uses	75.8	79.9	78.1	75.0	71.0	68.4	66.4	65.6	63.3	59.1	54.4
End of year debt outstanding/ Total cash income	198.6	211.3	226.1	234.8	295.2	307.5	325.0	328.3	355.8	409.2	480.1

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[1] Numbers may not add due to rounding. [2] Cash sources of funds from sale of real estate to the nonfarm sector are not included due to lack of data. [3] Does not include labor perquisites in calculation of production expenses before subtracting from gross cash income. [4] Does not include Commodity Credit Corporation loans. [5] Includes net additions to household furnishings, commercial bank deposits and currency, savings bonds, equity in farmer cooperatives, and purchases of breeding livestock.

brought under control. After the first few years of the decade, farmers will face rising current returns with an expanding equity base. It would be difficult to conceive of circumstances where credit would not be made readily available to the farming sector if this happened.

However, if the general economy goes through a prolonged period of "stagflation"—that is, a stagnant real growth in output and continued inflation—the farm economy will face major difficulties in finding financing. Debt might increase to almost six times its 1979 level, and farms would then account for more than twice their historic share of national private debt. Interest expenses would be over $86 billion per year in 1990, or almost 20 percent of production expenses. In this case, all the weaknesses of the institutions providing debt funds to agriculture would be magnified. Farm loans would be considered very risky; therefore, insurance companies and urban banks would tend to withdraw from farm lending. States with unit banking laws would find commercial banks unable, even if willing, to make loans large enough to meet the needs of farmers. Small, less efficient farms would likely be forced out of the sector during the long stretch of low farm income. Even the Farm Credit System (FCS) would be forced to keep lending below the demand for its loans. Several years of poor farm incomes and declining farm equity would leave fewer and fewer farmers in a position to meet the FCS's creditworthiness standards. The FCS could itself become a major factor in the national money markets if its market share grows and if the proportion of total private debt that farmers owe increases. This in turn might generate congressional criticism as the system "crowds out" other farm lenders and begins to compete with Treasury borrowing. It is very difficult to foresee the effects of all these actions on individual and other private sources of debt. However, it is hard to believe that they would want to increase their lending to an industry with declining profits and collateral. Thus, Government loan programs, through the Farmers Home Administration, the Commodity Credit Corporation, and the Small Business Administration, would be required to increase their farm lending substantially. Even if Government programs merely maintained their market share of farm debt outstanding on January 1, 1980 (at 12.7 percent), their loans would grow to $117 billion by January 1, 1991. More likely, their market share would increase. If it were to double to as much as 25 percent, Government lending to agriculture would be $230 billion.

Conclusions

If Government monetary and fiscal policy is tightened so that inflation slows and real output grows steadily over the next decade, the farm sector will likely be in excellent financial condition by 1990. After 3 or 4 years of low net farm incomes, real returns to farming should grow substantially in the latter half of the decade. Some of these increases will be capitalized into higher real estate values. With a high enough growth rate in net farm income, however, the historic trend toward ever higher debt-to-asset ratios by farms can be reversed. In the baseline forecast, farm debt is projected to grow to over $500 billion by the end of 1990. Yet, interest payments on this debt represent a decreased constant dollar burden on farmers.

It will be harder to start a farm in the first years of the eighties while net income is low and interest rates are high. It may also be difficult to start a farm later in the decade, as real estate values will likely increase rapidly after a few years of growing net farm incomes. However, in the mideighties, new farmers should be encouraged if inflation is being controlled.

If monetary and fiscal policies do not produce a healthy general economy, the farm financial situation will likely be very poor by the end of the decade. Slow growth and high inflation would assure slower increases in prices received by farmers than those they must pay for inputs. This would create a cost/price squeeze that would reduce net farm income in both nominal and real terms throughout the decade.

In this case, Government involvement in agriculture will be more important than if inflation is controlled. Even so, the U.S. Department of Agriculture (USDA) programs might not leave farmers in as good a financial position as they would be able to reach with a healthy general economy. Under both high-inflation scenarios, farm debt is forecast to grow to almost $1 trillion by the end of 1990. With lower farm incomes and equities, private institutional lenders will likely reduce their proportion of farm lending, placing Government programs—such as the Farmers Home Administration, the Commodity Credit Corporation, and the Small Business Administration—in a position where they may be lending as much as $230 billion to agriculture by the end of the decade.

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The Role of the Farm Credit System in Financing Agriculture

By Richard S. Fenwick, C. Edward Harshbarger, and Gene L. Swackhamer*

Abstract

With outstanding debt held by the Farm Credit System projected to exceed $200 billion by 1990, compared with about $60 billion at the start of 1980, a further rise in the System's share of total farm debt is likely. Expected rapid rises in both farm asset values and production expenses in the eighties along with unsteady farm income will adversely affect farmers' repayment and credit capacity, increasing lending risks to the System. Because of rapidly growing credit demand, an increased capital base will be a major goal of the Farm Credit System. It is possible that the System will borrow on foreign money markets. New regulatory pressures from the Congress and demands for review of the System's functions by competing lenders may also occur.

Keywords: Farm debt, Farm credit, Farm Credit System, Financial issues, Market share

Introduction

In this article, we predict the major issues facing the Farm Credit System in the eighties—which may well equal the seventies as the most dynamic decade in the System's history. To place these issues in perspective, we review the historical development of the System as an institutional source of agricultural credit. We then use a 1980 Farm Credit Administration report as a framework to outline the System's likely role in financing agriculture over this decade *(6)*.[1]

Historical Background

The Farm Credit System comprises 12 Federal Land Banks (FLB's) and 494 Federal Land Bank Associations (FLBA's), 12 Federal Intermediate Credit Banks (FICB's) and 424 Production Credit Associations (PCA's), 13 Banks for Cooperatives (BC's), a finance office in New York City, and a joint service office, Farmbank Services, in Denver. These private organizations are completely owned by their borrowers and operate under a Federal charter, the Farm Credit Act of 1971 as amended. The banks, associations, and service offices are subject to the rules and regulations of the Farm Credit Administration (FCA), an independent agency of the executive branch of the Government. This agency is under the operational direction of a Governor, who in turn is employed by the Federal Farm Credit Board, a 13-member, presidentially appointed body which provides policy direction to the Farm Credit Administration.

The Farm Credit System is a federation of special-purpose institutions created by and initially capitalized by the Government to better meet the financing needs of U.S. agriculture. The System began in 1916 with the establishment of the FLB's to provide farmers with long-term real estate mortgage loans. The terms of these loans were designed to be compatible with the unique characteristics of agriculture and were more reasonable than those available from other lending sources. The mission of the FLB's is essentially unchanged today.

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[1] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

The FICB's were created in 1923 to provide discounting privileges to commercial short-term lenders in agriculture. For several reasons, not the least of which was the perceived "lender of last resort" stigma, farmers did not receive the credit services they needed. To remedy this problem, the Congress in 1933 authorized farmer-owned PCA's to make short- and intermediate-term loans to farmers that could be discounted with the FICB's. Although modernized through time, the mission of the FICB's and PCA's is essentially unchanged today.

The BC's, which were organized in 1933, are the third key part of the Farm Credit System. Their mission is to provide seasonal and term loans to farmer-owned marketing, supply, and service cooperatives.

The Farm Credit System has not grown uniformly over the years; legislative changes and new competitive relationships have triggered spurts of growth, including three such growth periods since 1965 (fig. 1). The first of these occurred with the closing of the Suez Canal, escalation of American military involvement in Vietnam, and depletion of grain reserves which caused a burst in commodity prices and an upsurge in agricultural credit demands. The second period of rapid growth resulted from passage of the 1971 Farm Credit Act, which provided both increased flexibility and new lending authority. Record levels of farm income also stimulated loan demand. In 1973-74, System loans outstanding increased at an average annual rate of 22 percent. The third growth surge began in 1979, when loans outstanding increased nearly one-fourth, and continued at a high rate in 1980. Unprecedented high interest rates during this period gave a competitive advantage to the Farm Credit System. Escalating farmland values and farm production costs, both of which increased real and nonreal estate loan demand, also caused greater demand for agricultural credit.

Although loans outstanding in the System have risen steadily, the System's share of annual net increase in total farm debt, illustrated in figure 2, has varied widely, from a low 22 percent in 1965 to a high of 52 percent in 1970 and again in 1974. Competitive relationships with other lenders frequently

Figure 1
Farm Credit System:
Annual Growth in Loan Volume Outstanding

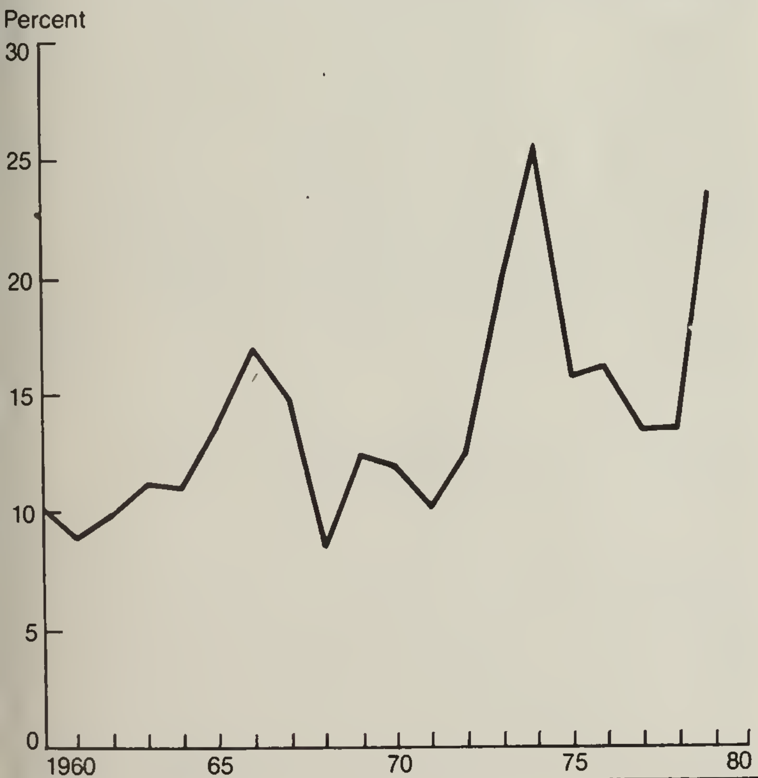
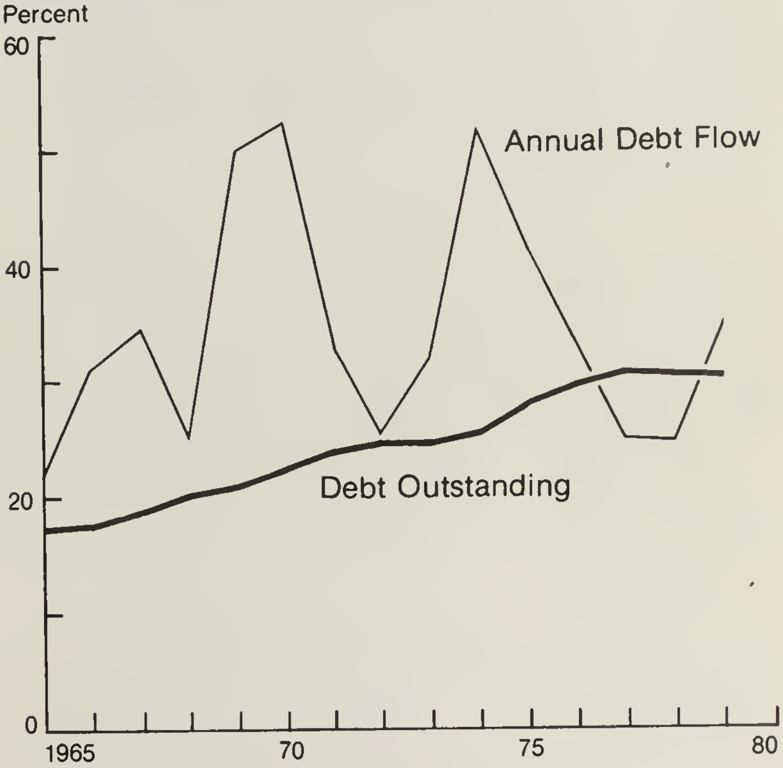


Figure 2
Farm Credit System: Shares of Annual Debt Flow and Debt Outstanding



determine how much of the new debt is financed by the System.

Earlier Projections

Most projections made 10 to 15 years ago predicted that outstanding farm debt would range between $100 billion and $137 billion in 1980 *(1, 2, 5, 8)*. Although the total outstanding farm debt as of January 1, 1980, was over $157 billion, the lower estimates made a decade or more ago were realistic. These projections were made when the general rate of inflation was modest and the land market was more stable. Furthermore, farm input prices—especially those for petroleum-related goods—underwent an explosion during the seventies that few people could have imagined a decade ago. Earlier debt projections, thus, fell short of the mark because they assumed relatively modest price advances for farmland and various farm inputs.

In 1968, Brake suggested that the credit furnished to farmers in 1980 would adequately meet their needs but that the relative importance of lenders would change *(1)*. Brake assumed that by 1980 the share of the farm debt market held by commercial banks and life insurance companies would decline. The market share of commercial banks would shrink because deposit growth would not keep pace with loan demand, whereas life insurance companies would elect to invest their loanable funds in more lucrative outlets than farm mortgages. Furthermore, Brake assumed that the Farm Credit System and noninstitutional lenders—such as private individuals and merchants—would garner a larger market share by 1980.

The latest available information shows that Brake was on target in nearly every instance. However, "individuals and others"—as did commercial banks and insurance companies—lost a share of the market to the System. As of January 1, 1980, the Farm Credit System held 31 percent of all farm real estate and nonreal estate debt, compared with 19.5 percent in 1968. Commercial banks held 25 percent at the beginning of 1980, while insurance companies held 8 percent, and "individuals and others" held 23 percent.

Several factors explain the System's growing market share during the seventies. The increase in loan-deposit ratios at rural commercial banks restricted their ability to keep pace with loan demand, causing some farm customers to go elsewhere for credit. Also, during several periods, while usury laws and other lending regulations effectively curtailed the operations of several types of lenders, the System remained exempt from many of these restrictions. Finally, through most of the past decade, the System was able to offer both current and prospective borrowers interest rates on loans generally lower than those offered by competitors.

Issues Facing the System

The System will encounter many challenges during the eighties as it grapples with dynamic financial markets, changing market structures, and an uncertain economic environment. Although System analysts will follow developments in the general economy and financial markets closely, issues relating to agriculture and agricultural cooperatives will demand most of their attention.

An important issue the System and other lenders will have to address is how to maintain repayment capacity when net farm income fluctuates widely. During the seventies, net farm income was highly volatile, which imposed occasional hardships on farmers. Although there was concern about the financial health of agriculture during the low-income years, many farmers avoided major crises by refinancing their loans and borrowing against the equity in farm real estate.

It appears that net farm income will remain volatile in the eighties, with comparatively few good years. However, the income picture could be brighter if farm exports exceed current expectations. Farm debt is expected to increase rapidly. Therefore, repayment capacity—as measured by traditional debt-to-income ratios—will likely come under increased stress. Several lean farm income years back-to-back and a simultaneous slowdown in the appreciation of farm real estate values could jeopardize the ability of farmers to repay existing loans and to borrow new funds for operating purposes. Thus, maintaining borrower repayment capacity will be a major challenge for all lenders.

Another issue of significance to the System is the changing structure of agriculture. Trends toward fewer, but larger, farms suggest more use of credit by individually owned and incorporated farms. While larger loans offer the System greater internal operating efficiency, they also increase risk exposure, especially when a farm operation is tied to one person's managerial ability. Furthermore, as the proportion of total cash needs generated internally diminishes, the risks are magnified. The System, therefore, will have to examine carefully how borrowers can make proper use of such risk aversion mechanisms as futures markets and Government crop insurance.

If commercial banks are unable to maintain their dominance in the nonreal estate debt market, this financing burden will partially shift to other lenders. In the last decade, as deposit growth and loan limit increases failed to keep pace with the increasing credit demands of farmers, the market share of total farm debt held by commercial banks declined. Furthermore, the sharp expansion in Government lending programs since 1977 has reduced the market shares for both commercial banks and PCA's. To the extent banks continue to have liquidity problems, new lending opportunities will be created for the System. However, with the gradual phase-out of Regulation Q, which limits interest that can be paid on deposits, commercial banks will have more flexibility in attracting deposits and staying competitive with other lenders, although the phase-out will likely increase operating costs. If the favorable interest rate differential that PCA's have enjoyed in recent years should also dwindle, the loss of market share by commercial banks to the System will likely slow significantly.

Increasing loan demand raises questions about credit quality. Obviously, the System has to assume some risk or it does not fulfill its mission of supplying credit to the farm sector. But, at what point would an increase in business lead to a decline in credit quality that would not only result in loan losses but also jeopardize the entire concept of a cooperative credit institution? At what point would competing lending institutions react and seek congressional action to limit the System's lending authority? Although these questions have no definite answers, the System must be cognizant of them.

The System expects to increase its market share for both real estate and nonreal estate farm debt in the eighties. Thus, the funding requirements for the System will be enormous. Farm credit obligations are issued in domestic credit markets; however, with expanding pressures to obtain more funds at the lowest possible cost, the System will likely have to consider other alternatives. The economic climate and credit market structure facing the System are more vulnerable to international uncertainties, external shocks, and changes in Government policy than in the past. Consequently, the System may increasingly scan the world for the lowest cost and most accessible sources of funds, including the Eurobond market, the Asian bond market, and private placements through domestic or European syndicates. Currently, there is little incentive for broadening the funding operation to include international markets, but many of the barriers are gradually being eliminated, which could make this alternative more attractive in the future.

The issues confronting the BC's are as perplexing as the challenges facing the other two branches of the System. The BC's role in financing U.S. agriculture is influenced by characteristics unique to farm input and product markets. Generally, BC growth is a function of the growth of cooperatives themselves. It is also a function of the BC market share of the cooperative credit market, the ability to capitalize the 13 Banks, and changes in regulations. Another factor that may affect future BC growth is their ability and willingness to be innovative in meeting the needs of borrowers.

The capital and credit requirements of cooperatives depend largely on gross farm income, resource production shifts, cooperatives' share of agricultural markets, and their ability to generate equity capital. A strong relationship ($R^2 = 0.939$) exists between the business volume of cooperatives and gross farm income, based on data from 1950/51 to 1976/77. Given that gross income will rise in the future, cooperative business volume will probably increase greatly, resulting in heavy credit demands. However, the new growth in cooperative business volume tends to understate the magnitude of cooperative seasonal credit needs. In periods of price instability, for example, seasonal credit needs can increase very sharply in a short period of time.

Production resource shifts will affect cooperative growth by changing potential market size. A shift from cotton to soybeans in a specific geographic area will alter business volume and the credit needs of a cotton cooperative located in that area. Such a shift can also affect the credit quality of each cooperative.

Cooperatives typically have a strong market share in commodities where open market pricing has deteriorated or where cooperatives are complemented by the underpinnings of market orders *(10)*. As open-market pricing deteriorates in more and more commodities, cooperatives may be formed to enhance the pricing mechanism. However, pure bargaining cooperatives are neither asset- nor capital-intensive. If cooperatives continue to integrate backward to become more basic in supply inputs, or to integrate forward into further processing, then capital and credit requirements will increase significantly.

The structure of production agriculture is also an important issue for cooperatives. As farms become larger and fewer, they are capable of buying input supplies of marketing products directly, bypassing local cooperatives. This trend could affect business volume, especially for federated cooperative structures.

If cooperatives are able to maintain their market share, their future capital and credit requirements will be sizeable. Their ability to finance this growth, however, will reflect their ability to obtain both debt and equity capital. The availability of equity capital to cooperatives poses greater concerns than the availability of debt capital. Equity capital as a percentage of total cooperative assets declined from 57.1 percent in 1954 to 41.7 percent in 1976 *(9)*. Data on cooperative participations at the Central Bank for Cooperatives support this finding.

Partly because of recommendations of the U.S. General Accounting Office (GAO), equity retirement is another policy issue facing cooperatives *(12)*. The issue, however, is broader than equity retirement alone. It includes the required rate of return on new asset expenditures to provide cash flow to service debt, service equity, and accommodate anticipated growth. Research is needed to determine how members measure benefits from investments in their cooperatives.

Another issue is how to finance a regional or interregional cooperative when its total credit needs exceed the lending limit of the BC's. Major mergers or acquisitions could exacerbate this constraint. One study indicates that from 30 to 43 farmer cooperatives may exceed the BC lending limit by the year 2000 *(7)*.

Such a trend in mergers would limit the growth of the BC's during the eighties. However, merger and acquisition activity could be limited by antitrust legislation, another major issue facing cooperatives *(3, 4)*. It should also be noted that the new farm credit legislation will permit the BC's to participate overline loans with the FLB's and the FICB's, which will enhance their ability to keep large cooperative accounts.

It appears that the BC's may be able to maintain their market share of the credit needs of farmer cooperatives in the eighties. Future market shares will depend on BC competitiveness in rates, loan maturities, and credit-related services. Some BC's now offer fixed-rate, matched-funded programs to cooperatives with large credit needs. Bankers acceptances and industrial revenue bonds are also used more frequently by cooperatives as a source of debt capital *(11)*. In the future, other innovative approaches will be developed and implemented to satisfy the credit requirements of cooperatives.

The System's Future Role

As previously noted, the FCA recently completed a major study designed to support its long-range planning efforts. Entitled *Project 85*, the report contains long-term projections for the general economy and the farm sector. We used these projections to assess the System's role in meeting the future credit needs of agriculture.

The FCA analysts used a baseline scenario which assumed no unusual economic or social shocks to the economy through 1985. Further, they assumed that real gross national product would increase at an average annual rate of 3 percent (1972 dollars). The general level of inflation was assumed to average 8 percent over the 5-year period, and the annual increase in the volume of U.S. agricultural exports was expected to average 5 percent. These assumptions appear sound, although current inflation remains above 8 percent and record-breaking U.S. agricultural exports are forecast for the next 2 years.

Recognizing that forecasts of future developments are frequently wrong, the FCA analysts also considered two alternative economic scenarios. In one alternative, they assumed that increases in both inflation and farm exports would be slower than in the baseline case—6 percent and 0 percent, respectively. In the second alternative, they assumed 12-percent inflation and 8-percent export growth. As expected, results differed from the baseline scenario.

Under the baseline scenario, total farm assets, proprietors' equities, and total debt were projected to rise about 10 percent per year in nominal terms, but real net farm income was projected to remain relatively low. The rapid growth in farm assets eflected primarily the effect of inflation on farm eal estate prices and land values.

Although the number of farm transfers has been declining, the amount of acreage transferred each year has remained nearly constant. Thus, given that the proportion of sales that are debt-financed has been rising, the need for real estate debt financing is expected to increase sharply. The FLB's, currently the dominant institutional lender, will experience greater demand for mortgage credit, which probably will push their share of the outstanding real estate debt above 40 percent by the end of the decade.

As a percentage of assets, proprietors' equities were projected to remain relatively constant over the study period. Although net farm income was expected to strengthen by 1985, most of the growth was attributable to inflation. In real terms, net farm ncome for 1981-85 was projected to average slightly higher than the $13 billion average for 1975-79. Growth in farm debt was expected to moderate from 14 percent in 1975-79 to 9 percent in 1980-85. However, a higher rate of inflation or better-than-expected levels of real net farm income could easily reverse this projection. For example, when a 12-percent average inflation rate was assumed, the annual farm debt increase was close to 15 percent.

Although the projected growth rate of farm debt may appear low relative to inflation, asset growth, and the increase in proprietors' equities, the financing of this debt will likely cause farmers significant stress, particularly if real net farm income remains low. Without steady growth in farm income, higher debt levels command more net cash flow and nonfarm income for servicing. Although the commonly used debt-to-asset ratio of the farm sector may remain nearly constant at about 18 percent, the ratio of debt outstanding to net farm income (a rough approximation of repayment capacity) is expected to rise significantly by 1985 (see table). This increase is a clear warning to lenders that increased delinquencies may be imminent.

Under these conditions, we can expect a continued high level of debt refinancing in the eighties as farmers seek to convert capital gains into cash. Also, nonfarm sources of income will become increasingly important as a way of servicing debt, although most of this income will continue to be earned by small farm operators.

In the baseline projection, debt held by the Farm Credit System was projected to total nearly $100 billion by 1985, including BC loans to farm cooperatives. In 1980, the System had $58.5 billion in outstanding debt. No projection was made for 1990; however, using the baseline economic and social assumptions, and assuming further gains in the share of the farm lending market, the System's debt holdings could easily exceed $200 billion. At this level, FLB's, FICB's, and PCA's would probably hold nearly 40 percent of all farm debt. The BC's

Relative use of debt in the farming sector, 1970-85

Year	Net debt flow[1]	Ratio of debt outstanding to net farm income[2]	Ratio of net debt flow to net farm income	Ratio of net debt flow to capital purchases[3]
	Billion dollars	*Percent*		
1970	2.3	379	16	17
1971	4.2	380	29	28
1972	6.7	337	36	33
1973	9.8	221	29	45
1974	8.1	315	31	22
1975	9.0	375	37	39
1976	11.2	537	60	40
1977	13.2	575	67	43
1978	17.4	471	63	44
1979	21.1	494	68	51
Averages:				
1970-74	6.2	326	28	29
1975-79	14.4	490	59	43
1985, proj.:				
Low inflation-low exports	12.3	636	36	—
Baseline	25.5	569	53	—
High inflation-high exports	51.6	548	76	—

— = Not available.

[1] Net change in loans outstanding during the year, excluding Commodity Credit Corporation (CCC) debt.

[2] Debt outstanding at year end, excluding CCC debt; income during the year includes change in inventories.

[3] Capital purchases include machinery, buildings, land improvements, net change in financial assets, net purchases of breeding livestock, purchases of real estate from discontinuing proprietors, and net additions to household furnishings.

Sources: Ratios computed from *Agricultural Finance Outlook*, November 1979, and *Farm Income Statistics*, October 1979, Econ. Stat. Serv., U.S. Dept. Agr.

share of cooperative debt would probably remain steady at about 60 percent during the eighties.

The alternative scenario projections suggest that the 1990 figures for net farm income, total farm debt, and the System's market share could deviate significantly from the baseline. Briefly, farmers would likely profit from high inflation because of strong farm exports. Land prices would rise sharply, resulting in significantly larger debt and a greater market share for the Farm Credit System. Low inflation coupled with zero growth in farm exports, on the other hand, could cause farmers serious financial stress. Net farm income would likely dwindle and land prices might actually fall. Assuming a significant drop in interest rates, lenders competing with FLB's could offer more attractive interest rates to farm borrowers, causing the System to lose some market share. Although we concentrated on the most likely scenario, the consequences of being wrong are significant enough that the alternative scenarios should not be ignored whenever making long-range plans.

Current economic forces could produce greater change in the Farm Credit System in the eighties than in any previous decade. We expect continued rapid growth in loans by the System and further increases in its share of the farm debt market.

It is also likely that regulatory, legislative, and social pressures on the System will increase. Congress may be tempted to use the System as a vehicle for services delivery or achievement of new social objectives. Public debate over the aims and performance of the System may be touched off by: (1) periodic concern about farmers' need for funds and appropriate application of these funds to assure high levels of agricultural production, (2) competitive fears from other institutional lenders regarding real or perceived System power, and (3) suspicion from agricultural organizations about the farm-related business and service motives of the System. Unfortunately, those in the System could react with growing conservatism and caution, thereby lessening innovative and imaginative credit services to farmers and their cooperatives.

The Farm Credit System, in our opinion, is well-equipped to deliver competitively priced credit in packages needed by farmers in the eighties. The System will still experience problems coping with internal structural change, the growing need for management information systems, and increasing external pressures. The banks, however, are currently addressing these issues.

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Agricultural Lending by Commercial Banks

By Peter J. Barry*

Abstract

Competition in financial markets is increasing. However, successful adjustment by banks to changing regulations, along with further development of nonlocal sources of funds, should reduce periodic liquidity stresses and swings in credit availability for farmers. Costs of funds will be higher and more volatile, thus increasing the need of agricultural banks for efficient, competitive pricing on farm loans and other services to maintain their position in farm credit markets.

Keywords: Agricultural banking, Farm loans, Bank regulation, Farm credit

> "... As civilization ... came to an Indiana or Michigan crossroads in the 1830's or 1840's, so did a bank. Its notes when issued and loaned to a farmer to buy land, livestock, seed, feed, food or simple equipment put him into business. If he and others prospered and paid off their loans, the bank survived. If he and others did not so prosper and pay, the bank failed.... But, some borrowers from this bank were now in business" *(11*, p. 85*)*.[1]

Introduction

Commercial banks have played a major role in financing the capital and credit needs of U.S. agriculture. They have contributed to financing the mechanization, modernization, and growth of farm operations and to expanding U.S. food production. Moreover, except in some branch banking States and in specialized operations, such as cattle feedlots and broiler units, smaller unit banks located in nonmetropolitan areas have assumed principal responsibility. Hence, Galbraith's portrayal of frontier banking and the close relationship between the financial performance of farmers and rural banks is still relevant. However, agricultural banks stand at a crossroads regarding their ability to continue meeting farmers' credit needs.

In this article, I focus on the changing environment in which commercial banks will finance agriculture in the eighties. After reviewing banks' involvement in farm lending during 1950-80 and positing factors that will make the eighties a crucial decade in shaping future farm credit markets, I consider the implications for agricultural banking of: (1) changes in the regulatory environment of financial institutions brought about by the Depository Institutions Deregulation and Monetary Control Act of 1980, (2) developments of nonlocal sources of funds for rural banks, and (3) other possible regulatory changes.

Bank Involvement in Farm Lending

The involvement by banks in farm lending is shown by their share of debt relative to other lenders and by the distribution of farm debt among various banks. Tables 1 and 2 show levels and shares of farm debt, classified as real estate and nonreal estate, for major farm lenders during 1950-80. Banks' share of farm real estate debt has been comparatively minor, totaling about 12 percent during the sixties and seventies and then declining to 10.5 percent in 1980.

The level and the market share of nonreal estate farm debt held by commercial banks are clearly high. Their farm loan volume experienced the largest growth among nonreal estate lenders during

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[1] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

Table 1—Nonreal estate farm debt outstanding as of January 1

Year	Production credit associations		Other financing institutions		Commercial banks		Individuals and others		Farmers Home Administration		Commodity Credit Corporation		Total
	Million dollars	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*
1950	387	5.6	51	0.7	2,049	29.8	2,320	33.7	347	5.0	1,721	25.0	6,875
1955	577	6.1	58	.6	2,934	31.2	3,210	34.1	417	4.4	2,219	23.6	9,415
1960	1,361	10.7	90	.7	4,819	38.0	4,860	38.3	398	3.1	1,165	9.2	12,693
1965	2,277	12.7	125	.7	6,990	39.0	6,330	35.3	644	3.6	1,543	8.6	17,909
1970	4,495	18.9	218	.9	10,330	43.3	5,340	22.4	785	3.3	2,676	11.2	23,844
1975	9,519	26.8	374	1.1	18,238	51.3	6,050	17.0	1,044	2.9	319	.9	35,544
1980	18,323	24.4	666	.9	31,034	41.3	11,720	15.6	8,892	11.9	4,500	6.0	75,225

Table 2—Real estate farm debt outstanding as of January 1

Year	Federal land banks		Life insurance companies		Commercial banks		Farmers Home Administration		Individuals and others		Total
	Million dollars	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*	*Percent*	*Million dollars*
1950	965	17.3	1,172	21.0	932	16.7	202	3.6	2,308	41.4	5,579
1955	1,280	15.5	2,052	24.9	1,161	14.1	379	4.6	3,374	40.9	8,245
1960	2,335	19.2	2,820	23.1	1,523	12.5	676	5.5	4,828	39.6	12,182
1965	3,687	19.5	4,288	22.7	2,417	12.8	1,285	6.8	7,218	38.2	18,895
1970	6,671	22.9	5,734	19.6	3,545	12.1	2,280	7.8	10,953	37.5	29,183
1975	13,402	29.0	6,297	13.6	5,966	12.9	3,215	6.9	17,408	37.6	46,288
1980	29,642	36.1	12,165	14.8	8,623	10.5	6,556	8.0	25,137	30.6	82,123

1950-80. Moreover, their share of total nonreal estate debt gradually increased, beginning in the midfifties, and it exceeded 50 percent in the midseventies. After 1977, however, their market share declined sharply to 41.3 percent in 1980—a level more comparable to the late sixties.

When loans from "individuals and others" are excluded from the data series, the fluctuations in banks' shares of farm debt held by institutional lenders are more pronounced. For example, the early sixties show a decline in banks' share of institutionally held nonreal estate debt, followed by an increase, and then they drop sharply in 1969, perhaps resulting from the 1969-70 credit crunch. Their shares rose again in 1974, a time of record-high farm incomes. Banks' shares then declined, dropping sharply in the 1979-80 period.

These fluctuations in banks' share of institutionally held debt appear closely correlated with changes in shares held by U.S. Government agencies—Farmers Home Administration (FmHA), Commodity Credit Corporation (CCC), Small Business Administration (SBA). Hence, both problems in credit availability at rural banks during tight monetary periods and adverse farm income, which hampers loan repayments and deposit growth, help to explain periodic declines in banks' market shares. More liberal lending authority for FmHA and SBA through economic emergency programs has further stimulated the recent decline in banks' market shares.

Substantial differences in banks' market shares of farm debt occur among States and regions *(4)*. For nonreal estate debt, their highest shares are in the Northern and Southern Plains and in the central Corn Belt; their lowest shares are in the Appalachian and Southeast regions. For farm real estate debt, their highest market shares are in the Appalachian and Northeast regions; their lowest shares are in the Mountain and Pacific regions.

Bank size, location, specialization, and type of branching affect the distribution of farm debt among banks. Money center banks generally finance larger operations involved in livestock and poultry production *(12, 21)*. This type of financing may include the entire United States. Money center banks in States with liberal branching laws may serve both large and small farming operations. These banks are further involved in agriculture by financing agribusinesses and international trade and through loan participations with regional and community banks *(18)*.

Regional banks also provide direct loans to large agricultural operations and agribusinesses, and they offer loan participations with smaller banks. When banks are ranked by farm loan volume, the top 50 banks are mostly in large cities, even though their farm loan volume is small relative to their other lending activities. Smaller, community-oriented banks located in rural areas are most heavily involved in farm lending.

Type of branching is closely related to bank size. On January 1, 1979, only 12 States required unit banking operations, 17 States allowed limited branching, and 31 States allowed statewide branching. Most unit banking States are deeply involved in farm lending because they are located in the major farming areas of the Midwest and Great Plains. As table 3 shows, banks in the 12 unit banking States account for nearly a half of the nonreal estate farm loans held by banks and about a third of the farm real estate loans held by banks. Banks in unit and limited branching States together account for about 80 percent of all nonreal estate farm loans held by banks. Furthermore, unit banking States generate about 36 percent of U.S. total gross farm income and hold about 42 percent of the value of all U.S. farm assets.

Table 3—Farm debt, gross farm income, and farm assets, by bank structure, January 1, 1979

Item	Unit	Unit banking States	Limited branching States	Statewide branching
States	Number	12	17	21
Nonreal estate farm debt	Million dollars	13,907	8,501	5,865
	Percent	49.2	30.1	20.7
Farm real estate debt	Million dollars	2,718	4,760	1,078
	Percent	31.8	55.6	12.6
Total gross farm income	Million dollars	45,616	46,759	32,539
	Percent	36.5	37.4	26.0
Farm assets	Million dollars	342,059	309,252	168,841
	Percent	41.7	37.7	20.6

ssues in Agricultural Banking[2]

The liquidity of agricultural banks is important ecause of their substantial involvement in farm ending and their heavy reliance on local markets or sources of funds[3]. Agricultural banks rely on ocal markets for acquiring deposits as a major ource of loanable funds; they have experienced eriodic disintermediation problems (a withdrawal f deposits which are then invested directly into he national money markets) when deposit funds ubject to legal interest rate limits were allocated o other investments during periods of rising inerest rates. These banks are especially vulnerable o local changes in farm income, which influence oan demands, loan repayments, and deposit acivities. These changes cause periodic stresses in ank liquidity and large swings in credit availability or farmers.

Federal Reserve data show that, although average oan-deposit (L-D) ratios for agricultural banks are generally lower than those for other banks, they ose to record levels in the late seventies. After emaining relatively insensitive to restrictive monetary policies in 1969-70 and 1973-74, L-D ratios f agricultural banks rose sharply during the low arm-income years of 1976 and 1977 as rapid loan expansion continued, whereas rates of deposit growth and loan repayment declined *(see 16)*. Then, as farm income improved, L-D ratios at agricultural banks rose more slowly in 1978 and leveled off in 1979, whereas L-D ratios at large nonagricultural banks simultaneously increased. L-D ratios for all banks then declined from their peak in mid-1979 to ower levels in 1980. At the end of 1980, agriculural banks' liquidity was much improved, resulting from, steady deposit growth and reduced loan demand.

Surveys of farm lending conditions yield further evidence on liquidity in agricultural banks. For example, the surveyed banks in several Federal Reserve districts showed considerable disparity between trends in farm loan demand and fund availability during the seventies. The greatest variation occurred in fund availability which declined substantially on several occasions.

Agricultural banks in unit banking States also have problems meeting larger farm loan requests that exceed banks' legal lending limits to individual customers. Benjamin points out that growth in the legal lending limits of banks in several Midwestern States has not kept pace with growth in farmers' credit needs *(7)*. A recent survey showed that more than half the agricultural banks in the Chicago district had more farm customers whose credit needs exceeded their banks' legal lending limits than they had 5 years ago. These banks must either develop loan participations with other lenders for these customers or risk losing their business *(7)*.

Bankers contend that problems in fund availability result from increasing competition for deposit funds in rural areas. Detailed data about flows of funds in rural financial markets are not available. However, table 4 shows national data on market shares of deposits held by major institutional sources. Long-term trends indicate that market shares for savings and loan associations and, to a much lesser extent, for credit unions have been growing. The shares for money market funds have also grown considerably in recent years. Commercial banks' combined shares of demand and time deposits declined from nearly 80 percent in 1950 to less than 60 percent in 1980, shifting toward time and savings deposits, especially the larger sized ones. These aggregate deposit patterns are reflected in the concerns of many agricultural bankers regarding competition for funds in local markets.

Prospects for the Eighties

The eighties will be a crucial decade for farm credit markets and for the continued role of commercial banks in financing U.S. agriculture. Conditions are too complex for us to extrapolate a pattern for the eighties from changes in recent years. As Hughes' projections in this volume show, the combined effects of numerous forces in the farm sector, financial markets, the general economy, and Government policy can strongly influence the future capital and credit needs of farmers.

Nonetheless, projections from Hughes' baseline model—based partly on a declining rate of general inflation and on the premise of Government involvement in agriculture similar to 1980 levels—indicate both stronger financial performance by the farm sector and more moderate growth rates for farm

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[2] For comprehensive reviews of past developments in farm credit markets and commercial banks' responses to changes in commercial agriculture, see *(1, 5, 8, 9,* and *20)*.

[3] The term "agricultural" bank is arbitrary; however, one study identifies as agricultural banks those with a ratio of farm loans to total loans which exceeds 0.25 *(17)*.

Table 4—U.S. deposits in commercial banks, thrift institutions, and money market funds[1]

Type	1950		1955		1960		1965		1970		1975		1978		January 1980	
	Bil. dol.	*Pct.*	*Bil. dol.*	*Pct.*	*Bil. dol.*	*Pct.*	*Bil. dol.*	*Pct.*	*Bil. dol.*	*Pct.*	*Bil. dol.*	*Pct*	*Bil. dol.*	*Pct.*	*Bil. dol.*	*Pct.*
Commercial banks:																
Demand deposits	93.4	56.6	110.2	49.4	118.4	40.2	139.4	30.4	175.8	27.4	228.1	20.4	261.5	17.3	270.9	16.4
Time deposits	36.8	22.3	50.0	22.4	72.9	24.7	146.6	32.0	233.1	36.3	455.5	40.8	615.6	40.6	660.2	39.9
Large negotiable certificates of deposit	0	0	0	0	1.1	.4	16.2	3.5	26.1	4.1	82.9	7.4	100.0	6.6	NA	NA
Large	NA	NA	NA	NA	4.1	1.4	11.9	2.6	29.1	4.5	75.5	6.8	108.4	7.2	NA	NA
Small	NA	NA	NA	NA	67.4	22.9	118.0	25.8	176.5	27.5	289.2	25.9	390.3	25.8	NA	NA
Savings and loan associations	14.0	8.5	32.1	14.4	62.1	21.1	110.4	24.1	146.4	22.8	285.7	25.6	431.0	28.5	472.1	28.6
Mutual savings banks	20.0	12.2	28.2	12.7	36.3	12.3	52.4	11.5	71.6	11.1	109.9	9.8	142.6	9.4	145.8	8.8
Credit unions	.7	.4	2.4	1.1	5.0	1.7	9.2	2.0	15.5	2.4	33.0	3.0	53.0	3.5	55.4	3.3
Money market funds	0	0	0	0	0	0	0	0	0	0	3.7	.3	10.8	.7	49.1	3.0
Total	164.9		222.9		294.7		458.0		642.4		1,115.9		1,514.5		1,653.5	

NA = Not applicable.

[1] Year-end data, except for 1980.

Source: Board of Governors of the Federal Reserve System, *Flow of Funds Accounts, 1949-1978*, Dec. 1979.

bt than in the late seventies. This outlook should prove the creditworthiness of the farm sector d strengthen the incentive for commercial banks enhance their competitive position in farm credit arkets, especially in nonreal estate lending.

is outlook and the responses by commercial nks are uncertain. Continued adjustment to fewer rms of larger size means that growth of debts on dividual farms will exceed the aggregate growth tes. This situation will exacerbate banks' prob- ms in meeting large loan requests that exceed gal lending limits. The dichotomy between the ancing needs of larger, more specialized farm erations and those of smaller ones which rely avily on off-farm sources of income will grow.

tergenerational transfers of farm estates may eate financing needs greater than anticipated. ew financing practices involving sources of equity pital, leasing, and risk bearing may modify future eeds for debt capital. High variability of farm in- me is anticipated, because of uncertainty over oth export demands for farm products and the im- acts on the farm sector of policies to control ergy, transportation, and inflation.

he financial market conditions during 1979-80 were e most severe of the last two decades with in- erest rates reaching record levels and displaying reat variability. Loan-deposit ratios in agricultural anks increased sharply in the seventies. The mar- et shares of major lenders of farm credit have own steady growth in lending by the Farm Credit ystem, fluctuation of market shares for banks and overnment lenders, and declining market shares other lenders. Competition for savings funds in ural financial markets has increased, and savers re more aware of yield, liquidity, and risk differen- als.

inally, how commercial banks' will finance griculture is uncertain because of new regulations hat could profoundly affect agricultural banks' osts of funds, their competitive position, and the ontinued involvement in farm lending by smaller nit banks. Hence, the impacts of changes in regula- ions, in bank structure, and in lending authority of he Farm Credit System need to be evaluated.

he 1980 Act

he Depository Institutions Deregulation and Ionetary Control Act of 1980 provides a comprehensive, coordinated revision of regulations that affect all U.S. depository institutions. Although some provisions became effective upon enactment in late March, most will be phased in over several years. Thus, during the eighties, banks and other depository institutions will need to adjust to a more market-oriented environment, making financial markets more competitive.

The 1980 act contains nine titles that include monetary control and reserve requirements, deregulation of interest rate controls, extended authorization of automatic transfer services (ATS) and negotiable order of withdrawal (NOW) accounts, increased deposit insurance, expanded powers for thrift institutions, pricing of Federal Reserve services, and preemption of State usury limits.

The act requires all depository institutions to hold reserves on all transactions accounts and on all nonpersonal time deposits. Depository institutions include commercial banks (members and nonmembers of the Federal Reserve System), mutual savings banks, savings and loan associations, and credit unions. Transactions accounts include demand deposits, NOW and ATS accounts, share draft accounts, and other accounts subject to withdrawal for purposes of making payments on transfers.

Required reserves are specified as 3 percent on the first $25 million of transactions balances, with that figure indexed annually on December 31 to rise or fall at 80 percent of the rate of increase or decrease of the aggregate of transactions balances in all covered depository institutions. Required reserves on larger transactions balances are subject to a rate of 12 percent. The rate of required reserves on nonpersonal time deposits with maturities of less than 4 years is 3 percent and for those with maturities of 4 years or more is 0 percent. The Federal Reserve Board can vary the reserve rate on large transactions balances from 8 to 14 percent and can vary the reserve rate on nonpersonal time deposits from 0 to 9 percent. The Federal Reserve Board also has the authority to impose a supplemental reserve requirement of not more than 4 percent of total transactions accounts on every depository institution when it needs to implement monetary policy more effectively.

Banks may hold reserves as vault cash, as balances at a Federal Reserve Bank, or—if a nonmember institution—as passthrough balances in another depository institution that in turn maintains such funds as balances in a Federal Reserve Bank. The reserve requirements will be phased in over an 8-year period for depository institutions which were not members of the Federal Reserve System on July 1, 1979, and over a 4-year period for member banks. Full reserve requirements on NOW accounts took effect December 31, 1980, when institutions in the 42 States outside of New England were first authorized to issue such accounts.

To deregulate interest rates, the 1980 act provides for an orderly and complete phase-out by March 31, 1986, of the ceilings on rates of interest and dividends that depository institutions may pay on deposits and accounts. The law suggests, but does not mandate, a phased step-up in present ceilings, and it requires that thrift institutions retain their one-quarter percentage point differential during the phase-out. Decisions about timing and the amount of increase are being made by a new deregulation committee composed of the Secretary of the Treasury, the Chairman of the Federal Reserve Board, the Federal Deposit Insurance Corporation, the Federal Home Loan Bank Board, the National Credit Union Administration, and the Comptroller of the Currency.

Other significant provisions of the act include the extension of authority for ATS accounts by banks, for remote service units by Federal savings and loan associations, and for share draft accounts by credit unions; the authorization of NOW accounts for all federally insured depository institutions, effective December 31, 1980; an immediate increase in the insurance limit on deposits and accounts from $40,000 to $100,000; expanded authority for savings and loan associations to invest up to 20 percent of their assets in consumer loans, commercial paper, and corporate debt securities along with more liberal lending limits on real estate mortgages; and preemption of State usury ceilings. Existing State usury ceilings on business and agricultural loans over $25,000 (subsequently amended to $1,000) were preempted for 3 years, subject to the right of affected States to override the preemption; they were replaced with a floating ceiling of 5 percentage points above the Federal Reserve's discount rate. State usury laws on mortgages were generally preempted, subject to the right of affected States to override the preemption if they act within 3 years. State usury ceilings on other loans made by federally insured depository institutions were permanently preempted subject to the right of affected States to override the preemption (except for national banks); a ceiling of 1 percentage point above the Federal Reserve discount rate will apply.

Implications of the 1980 Act

How new regulations in the 1980 act will affect the availability and cost of funds and the competitive position of agricultural banks in their local markets is a complex issue, involving both macro- and microeconomic forces *(23)*. The competitive position of banks relative to other lenders, especially the Farm Credit System, is also affected. How the process of deregulation responds to political pressures during the adjustment period is vital.

The impacts of the new regulations on smaller agricultural banks are especially important. These banks have experienced greater problems with fund availability. Regional and money center banks have suffered less from Regulation Q because of their access to funds in national financial markets, their greater capacity for liability management, and other financial innovations.

The act's new reserve requirements should release additional bank funds to support credit activities, particularly in rural areas. For any given level of reservable liabilities, the Federal Reserve's new requirements are much lower than were previous reserve requirements. Preliminary studies *(19)* show that vault cash will cover the new reserve requirements for most smaller banks, both members and nonmembers.

For member banks, the sterile (non-earning) balances previously held to meet reserve requirements may be available to support new credit activities. The case is less clear for nonmember banks who now will be subject to reserve requirements for both the Federal Reserve and their respective States. For the many nonmembers—especially small banks—whose vault cash will accommodate the new reserve requirements, sterile balances above those already required by States should not increase. And for those nonmembers who must hold additional sterile balances—either at a Federal Reserve Bank or in a passthrough balance at another depository institution—to meet the new Federal requirements, the impact on loanable funds could be lessened if State requirements are lowered. Some of the many States that already permit banks to hold balances with other banks to offset their reserve requirements, may extend this offset to balances held at a Federal Reserve Bank or to qualify passthrough balances.

The effects of new reserve requirements on correspondent relationships are an issue. If nonmemer banks meet the Federal requirements by pass- g through correspondent balances to the Federal eserve, these passthrough balances become sterile eserves for the correspondent. They are no longer vestable and cease to serve as compensation for orrespondent services, including loan participants. he impact on correspondent relationships will de- end both on the net effect of the new Federal re- uirements on the reserve position of nonmember anks and on the possible changes in pricing of cor- espondent services.

liminating interest rate controls on deposits and reempting State usury ceilings on loans should im- rove efficiency in flows of funds in local markets nd should make pricing policies more responsive to arket factors. Smaller banks should compete more quitably for local funds—especially for those funds hich, when interest rates are high, are channeled ito money market funds and other money market nstruments. Higher, more volatile interest rates on anks' deposits, as well as higher overall costs of ank funds, will accompany these changes.

t is difficult to predict how much the cost of funds or agricultural banks will increase. Federal Re- erve data show that, in the late seventies, increas- ig reliance was placed on money market certifi- ates and on 30-month certificates of deposit, both vith ceiling rates indexed to yields on U.S. Govern- ient securities. Thus, agricultural banks' costs of unds have already been affected by market factors. Furthermore, higher costs of funds should be par- ially offset by greater revenue from fees, service harges, and higher loan rates. Revenue from ser- ice charges and minimum balance requirements hould be especially important for interest-bearing ransactions accounts.

Banks' interest rates to loan customers will be trongly influenced by local competitive conditions. The competition between depository and nondeposi- ory institutions and the potential expansion in con- umer lending by savings and loan associations are especially important. If, for example, banks and other depository institutions experience similar in- reases in costs of funds, they may be able to pass hese costs along to loan customers simultaneously. However, increases in farm loan rates charged by banks may be constrained if the costs of funds to ending competitors, such as production credit asso- ciations and U.S. Government agencies, are not directly affected by local market conditions. Hence, bank's high costs of funds will make competitive pricing of loans and other services more necessary.

Differing degrees of competition may cause price differentials among different types of bank loans. Banks' farm loan rates may remain competitive with rates from nondepository lenders, whereas rates on nonfarm loans will be higher. Much depends on whether rates in rural financial markets continue to respond to rates in national markets. If so, differences in interest rates among major farm lenders will largely reflect differences in risk premiums, efficiency of intermediation, and regulations.

Once the new regulations become effective, banks will likely experience greater variability in their costs of funds, but reduced cyclical stress during periodic financial crises. Although periodic stresses in funds acquisition will be less severe, more careful monitoring of rates in local and national financial markets and efficient, responsive pricing policies on sources of bank funds and on loan portfolios will be required. Variability of loan rates will increase, and as lenders seek to pass risks of funds acquisition on to borrowers, they will use more floating loan rates.

The impacts of the 1980 act on the profits of agricultural banks are less clear. A recent study by the American Bankers Association indicates that most community banks successfully maintained their profit positions through the stresses of 1979-80.

Similarily, banks in New England that have dealt with NOW accounts for several years have successfully adjusted to interest-bearing transactions accounts. However, agricultural banks that have heavy involvement in farm lending and that must compete with other farm lenders, such as the Farm Credit System and Government lenders, may have more difficulty.

If more equitable access to local deposits is accompanied by higher interest rates, the smaller rural banks will be hard pressed to compete in farm lending, even if profit targets are lower as a result of more competitive financial markets. Instead, more bank funds may be allocated to investments in securities that maintain short term profits but erode longer term growth. This situation could encourage larger bank sizes and the liberalization of branching laws.

Nonlocal Sources of Funds

The 1980 act will have little impact on the need of smaller banks for access to nonlocal sources of funds. Most of those that influence the need for nonlocal funds will continue: loan requests which exceed legal lending limits, seasonal patterns in loans and deposits, liquidity pressures on loans and deposits caused by changes in farm income conditions, and the periodic need to reduce risks in loan portfolios and to restructure balance sheet ratios.

Rural banks can attract nonlocal funds to support farm lending in many ways. Among the more promising methods are the following: (1) loan participations, (2) agricultural credit corporations, and (3) secondary loan markets.

Loan Participations

Loan participations with correspondent banks have been a favorite means of obtaining nonlocal funds within the banking system. Many studies have been conducted on the procedures and pricing methods for correspondent participations, and their advantages and disadvantages are well known *(3, 6, 13, 15)*.

The 1980 act will influence correspondent participations in several ways. The willingness of farmers to accept higher, more volatile interest rates (perhaps based on floating rate policies), should make them more attractive customers for correspondent banks. Preemption of State usury ceilings on agricultural loans will allow farm loan rates to adjust to market levels during high loan rate periods. This freer adjustment will allow farm loans to compete more equitably with correspondents' other investments and will reduce the need for rural banks to provide compensating balances. Finally, using passthrough balances held by rural banks to meet new Federal Reserve requirements, together with using more fee payments for correspondent services, should help make interest rates the principal means of pricing for correspondent loan participations.

The following new participation arrangements among banks are also important: selling general participation pools to correspondents as a source of funds when loan demands are high and participating in a network of regional and money-center banks—for example, the Bank of America's Agricultural Loan Funding Program *(15)*. Cross-streaming of farm loans among banks of similar size, location, and experience may also increase loan participations with production credit associations (PCA's), Farmers Home Administration, and life insurance companies are other possible arrangements.

The 1971 Farm Credit Act authorized PCA's to enter into participation agreements with commercial banks, and it provided broad guidelines to assure that participating banks would not substantially reduce their farm lending. These arrangements have great potential for combining the farm lending specialization and money market access of PCA's with the loan-deposit relationships of banks, thus enhancing overall business activity in rural areas. However, only a few banks have developed loan participation arrangements with PCA's.

Agricultural Credit Corporations

Agricultural Credit Corporations (ACC's) are commercial corporations organized primarily to provide credit services to farmers. They are profit-oriented businesses that provide farm loans at interest rates which cover costs of funds, operation and administration, and risk bearing. Through a subsidy arrangement, ACC's offer a way for an individual commercial bank or a group of banks to fund farm lending from nondeposit sources. The participating bank or banks must provide initial equity capital for the ACC, which then is levered with other funds, resulting in debt-to-equity ratios that range from 6 to 1 to 10 to 1.

Once equity capital and ACC management are available, the main problem is to develop the source of funds. Two approaches are usually possible: acquiring funds by selling money market instruments, or discounting loans with Federal Intermediate Credit Banks (FICB's)—called lending to "Other Financial Institutions" (OFI's) by the FICB's.

The experience of banks with ACC's that sell money market instruments is limited. This procedure is feasible only for banks having close relationships with money center banks or regional banks and having customers (such as cattle feedlots) with large (above $1 million) and continuing credit needs. The following ACC's are of this type: (1) Northwest Agricultural Credit Company, which originally sold its own commercial paper but now generates funds by sale of holding company paper; (2) Central Ag Finance Corporation (currently inactive), which issued commercial paper secured by warehouse receipts and was guaranteed by its parent bank; (3) AgCo Corporation and Ag-Capital Corporation, which issue commercial paper guaranteed by commercial insurance; and (4) American Ag Credit Corporation, which, through ownership affiliation and loan participations with two bank-holding com-ies, uses bankers' acceptances primarily to ınce cattle-feeding operations.

e ability of ACC's owned by smaller banks to sell ney market instruments effectively is doubtful). Primary requirements are safety, liquidity, and ontinuous outlet to the market. Smaller banks ve difficulty generating enough volume and conuity; they also have high costs in providing the ds of collateral control or insurance to meet the ety preferences of investors.

sides serving PCA's, FICB's are authorized to n money and discount loans for eligible ACC's, nmercial banks, and OFI's. Although use of CB's is not extensive, a growing number of rural nks have formed ACC's to use the credit services FICB's. The volume of OFI loans and discounts is atively small, about 3-5 percent of the total loan lume of FICB's.

veloping a long-term relationship between ACC nks and FICB's seems to work best. FICB's are luctant to accommodate sporadic credit needs, pecially during periods of high interest rates and ht credit. The 12 FICB's also differ in their inrest and willingness to consider OFI relationships. e Farm Credit Act Amendments of 1980 are innded to modify and make more uniform the FICB licies about bank-affiliated OFI's, which should hance their use by banks. The amendments have vised capital requirements for discounting by nks and eligible loan purposes so they more close- resemble PCA's. New provisions also assure that e FICB discount privilege is reasonably available banks and to ACC's that meet the following reirements: ACC's must have (1) a significant inlvement in lending for agricultural or aquatic purses, (2) a continuing need for supplementary urces of funds for agricultural and aquatic purses, (3) a limited access to national or regional pital markets, and (4) no intention of using FICB nds to expand financing for parties and purposes eligible for discount with FICB's.

he ACC concept considered here includes coordiated efforts by groups of smaller banks on a State, gional, or national basis to gain access to nonlocal nds either through FICB's or by sales of money arket instruments. This idea has been proposed efore *(2, 10)*, but it may warrant reconsideration, pecially if geographic constraints on branch bankg are liberalized. The group approach would give ermanent size-related advantages to agricultural banks so as to preserve the features of a unit banking system and simultaneously help these banks cope with the larger size and regional-national orientation of other major farm lenders.

In a recent analysis, Williford proposes guidelines for organizing multibank ACC's. He estimates that a viable ACC would require a total loan volume of at least $50-100 million, an initial capital base of one-sixth of total volume, and partial retention of each farm loan by participating banks. Funding from money market sources would require a secured debt instrument, guarantees by a reputable insurance firm, and sound dealer arrangements. Funding from an FICB generally allows lower leverage than money market sources, requires pledging of securities, limits interest rate spreads, and yields more stable costs of funds. Both approaches would yield similar profits for the participating banks. However, nonquantitative factors—such as organizational and administrative issues, market acceptance, continued loan volume, and competitive relationships with the Farm Credit System—are also important. The recent formation of a multibank ACC in Minnesota and the consideration of similar ventures by other States are clear steps in this direction.

Secondary Markets for Farm Loans

Selling loans in secondary transactions provides liquidity for banks and generates funds for other uses. Although secondary markets are well developed for many financial assets, they are not well developed for most individual loans. Hence, farm and other loans are considered illiquid because of the absence of secondary markets.

Farm and other rural loans guaranteed for up to 90 percent of the loan amount by FmHA or by the Small Business Administration (SBA) are expected. The use of secondary markets for these loans has grown rapidly in recent years, enabling some rural banks to accommodate farm loans that are large in total volume, individual size, and with high risk. Lending risks are much reduced and rates of return from interest and service fees are attractive. The guaranteed portion does not count against a bank's legal loan limit. Brokers help find buyers for the loans. Hence, the bank has access to new loan funds and can retain loan servicing and other contacts with the borrower.

The development of a secondary market for farm-related loans is an important financial innovation.

However, little information is available about the size of the market, pricing relationships, liquidity characteristics, and the effects on rural banks' liquidity management. This information is important as the liquidity associated with secondary sales may play a key role in other methods that banks use to acquire nonlocal funds.

Other Regulatory Changes

Other important regulatory changes that may influence agricultural banks involve possible changes in bank structure and changes in the lending authority of the Farm Credit System. Prospects are promising for significant structural change in banking in the eighties because of liberalization of geographic restraints on banking activities. A presidential task force studying the issue in 1980 was expected to propose a substantial easing of restrictions on interstate banking. Modifying restrictions that prevent bank-holding companies from buying or setting up subsidiaries outside their home State, rather than changing State branching policies appears to be preferred. These changes could offer additional flexibility for tapping nonlocal sources of funds for farm lending.

The Farm Credit Act Amendments of 1980 include several provisions that should enable the Farm Credit System to work more closely with other lenders, including commercial banks, to meet the credit needs of rural America. However, the debate on this legislation has progressed far beyond the original content of the amendments proposed by the Farm Credit Administration to treat some of the basic differences in the regulatory environment for these two major farm lenders. In the eighties, legislators will likely continue to explore these issues.

Conclusions

Successful adjustment by agricultural banks to the new regulatory environment of the eighties, along with the further development of nonlocal sources of funds, should greatly reduce the severe, periodic stresses on liquidity experienced by many of these banks. When combined with strengthening the financial performance of the farm sector, these developments should enable banks to continue their major involvement in financing agriculture. Hence, they should be able to compete in farm credit markets to provide the kind of credit services farmers need for efficient production and marketing, growth in farm size, adoption of new technology, and liquid credit reserves. However, profound changes in loan pricing and credit programs will likely occur. Banks will continue to be strongly influenced by fluctuations in farm income and other agricultural developments in their local markets. Moreover, their future involvement in farm lending may reflect a greater tendency for large farming operations to establish customer relationships with larger agricultural banks.

More short-term variability in banks' costs of funds will increase the volatility of interest rates on farm loans and other types of loans. Use of floating rates should increase as lenders seek to pass costs and risks of funds' acquisition on to borrowers. Bankers will more closely scrutinize farmers' deposit relationships at banks, although greater prominence of pricing by interest rates will reduce the need for compensating balances. Similarly, more emphasis on loan pricing and analysis of customer profits should lead to greater use of risk pricing in interest rates on farm loans.

The effects on farmers of these pricing and funding developments will be greater variability in interest rates on bank loans but less variability in availability of loan funds from banks. These effects may seem to increase financial risks for farmers, because changes in interest rates are more obvious and easily measured than are changes in fund availability. However, financial risks may not increase if less risk in fund availability offsets the increased risks in costs of loan funds. Moreover, because interest rates are easier to measure than is fund availability, farmers should now have clearer signals about changing conditions in financial markets.

Use of floating rates may also influence other loan terms. Banks that adopt floating rates should have less need to shorten loan maturities because of their own liquidity risk. Hence, loan maturities for farm inventories, capital items, and other needs should increase. Collateral requirements on loans should become more stringent as a means of reducing credit risks. A factor offsetting floating rates is the potential reduction in marketability of farm loan paper in secondary markets. Finally, more farm financing will likely occur with formal lines of credit, commitments, and master notes in response to several factors: greater efficiency in loan pricing with floating rates, more careful monitoring of credit relationships, and improved financial planning by farmers.

arger agricultural banks will likely play an in-
reased role in financing larger farming operations.
arger agricultural banks with $25 to $100 million
total assets tend to be more diverse in their lend-
g activities and in acquiring local funds. Hence,
ey are less vulnerable to local agricultural devel-
pments than are smaller banks. Legal lending
mits for individual borrowers increase with bank
ze, and larger banks generally have better access
nonlocal sources of funds. Larger banks can bet-
r departmentalize farm lending along profit
nter lines. They may have personnel who are spe-
alized in farm lending, thus facilitating financial
alysis and credit administration of farms with
mplex legal organizations, financial structure, and
roduction characteristics.

ence, the pattern of bank financing of agriculture
ay follow closely the evolving structure of com-
ercial agriculture. Lin, Coffman, and Penn project
ntinued movement toward a bimodal distribution
f farm sizes—many small farms, an ever-increasing
roportion of large farms, and a declining propor-
on of medium size farms *(14)*. Banks' market
hares of farm debt may show a similar pattern
-concentration of debt for larger farms in larger
gricultural banks, with smaller banks lending to
maller farms. Thus, projected structural changes
agriculture may strongly influence banking activ-
ies, and the factors affecting banks' financing of
griculture may not have as strong an influence on
arm structure as they have in the past.

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Life Insurance Company Lending to Agriculture

By David A. Lins*

Abstract

As a result of high inflation and the use of fixed interest rate mortgages, life insurance companies have reduced the length of farm mortgage loans to 3-5 years. This allows them the latitude to adjust interest rates more frequently. They are also moving to acquire investments, such as farmland or shared appreciation mortgages, where returns are geared to the level of inflation. These changes should allow the life insurance industry to continue serving the credit needs of the agricultural sector.

Keywords: Life insurance companies, Farm mortgage loans, Inflation, Farm credit

Introduction

Life insurance companies have long been a significant source of farm mortgage loan funds for agriculture. However, financial market conditions in early 1980 caused most major insurance companies to substantially reduce or to temporarily suspend farm mortgage lending. Their actions, coupled with their declining market share of farm mortgage loans, have raised many questions regarding their future role in farm mortgage lending.

To assess this role, this article (1) presents the combined investment portfolio of all insurance companies and reviews the objectives which guide investment options, (2) presents a brief history of the market shares of life insurance companies and explains why market shares have changed, (3) describes sources of funds for life insurance companies and the expected future changes in these sources, (4) outlines the factors influencing future investment policies, and (5) suggests possible future farm lending procedures and loan terms which life insurance companies may employ.

Investment Objectives and Asset Composition

There are two basic types of life insurance companies, stock and mutual. The first type is capitalized by the issuance of stock; its main objective is to make profits for its stockholders. The second type has no capital stock or stockholders. Rather, its policyholders own the company. Mutual companies benefit policyholders either through low insurance premiums or high dividends. However, little difference exists between the objectives guiding their investment decisions.

The basic life insurance company function is to accumulate premiums paid by policyholders, invest the funds and earn income on them, and make payments to policyholders as they become due. Life insurance companies' investments are guided by three main objectives: (1) return, (2) safety, and (3) adequate liquidity. The desire to maximize returns on investments must be tempered by the need for safety and liquidity.

Returns on Investment

Returns on investment directly affect the competitive position of life insurance companies. As returns on investment increase, premiums on policies can be lowered or higher dividends paid. Companies with the best returns have a competitive advantage. Because higher returns are normally associated with more risky investments, State statutes prescribe limits within which investment activities of life insurance companies must be carried out. Obtaining maximum profits within these prescribed limits is a major challenge for portfolio managers.

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Dissatisfaction with the "forced" investment patterns of life insurance companies led to the development of "separate account funding." A separate account is a fund established by a life insurance company and held apart from all other assets of the company. State laws allow funds in separate accounts to be invested without regard to the usual restrictions. Separate accounts are used primarily to fund individual and group annuities. The amount of the annuity depends upon fund performance.

Safety

Life insurance companies must ensure that policyholder benefits are not jeopardized by risky investments. Losses in asset values are of primary concern. Legal restrictions on investments are designed to prevent major losses. However, for well-established companies, insolvency (when assets drop below liabilities) is not likely. Nevertheless, the level of surplus and the public reaction to the trends in surplus accounts help shape the investment strategy.

Liquidity

Liquidity, the ability to meet cash obligations when due without disrupting ongoing business, has become more important to life insurance companies in recent years. For example, rapid and unexpected increases in market interest rates in early 1980 created a tremendous cash flow drain for most life insurance companies because the demand for policy loans and low interest rates soared, and because pension-fund managers pulled money out of general account investments at life insurance companies to obtain more lucrative short-term rates from money-market funds. Insurance companies had committed huge sums of money at fixed rates under the assumption that interest rates had peaked. Honoring these commitments at interest rates below market rates created a further cash drain. Liquidity was a major problem during this period.

To meet the cash-flow crunch, life insurance companies greatly expanded their bank loans and sales of commercial paper. Rates paid on these sources of funds exceeded the rates charged on the fixed interest-rate commitments. Because of the depressed market prices of stocks and bonds, life insurance companies were reluctant to sell holdings in these assets. A subsequent drop in interest rates in mid-1980 eased the cash flow problems, but the need for better liquidity management pointed to industry changes *(4)*.[1]

Asset Composition

The total dollar volume of assets of life insurance companies in 1979 was over $431 billion (table 1). Since 1950, asset values have grown at nearly a 7-percent annual compound rate, although in 1970-79, the rate was about 9 percent. Farm mortgages have accounted for only 2-3 percent of life insurance company assets. As insurance companies have a variety of investment options, farm mortgages can compete only if they generate a return comparable to other investments with equal risk.

Overall, there appears to be a move toward higher yielding, higher risk investments. In percentage terms, life insurance company investments in Government securities have dropped substantially. Since 1965, the percentage share of investments in mortgages also has declined somewhat. However, the proportion of funds invested in stocks and policy loans has increased. These portfolio modifications reflect changing financial market conditions and the response of policyholders and investment managers.

Farm mortgage investments are widely scattered throughout the United States (table 2). In every State, except Alaska and Rhode Island, life insurance companies have some farm mortgage debt outstanding. However, the market share of farm mortgage loans held by life insurance companies varies considerably by State. In the Northeast, the headquarter area for many major companies, life insurance companies have a low share of the farm mortgage market. In contrast, the market share in some Delta and Western States is over 20 percent.

One reason is the differing size and density of farms among these regions. The Delta and Western States have many more large-scale operations, and insurance companies have favored larger farm mortgage loans (the average farm mortgage loan is about three times that for Federal Land Banks). A second reason for the geographical disparity is that, in the past, restrictive State usury laws have deterred lending by insurance companies in some States.

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[1] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

arket Shares of Life Insurance ompanies

ife insurance companies' market share of farm ortgage loans declined substantially between 1950 nd 1980 (table 3). Market shares of commercial anks and individuals also declined over this period, hile the market shares for Federal Land Banks nd the Farmers Home Administration increased. he market share of life insurance companies delined most notably in the early seventies.

easons for market-share decline have been the ubject of considerable controversy. Melton attribted the decline to four factors: (1) competition from onfarm mortgages with interest rates higher than arm mortgages, (2) the view by some companies hat agriculture was a subsidized industry unable to ay market rates, (3) a rapid increase in policy oans, and (4) State usury laws affect lending by life nsurance companies, but not Federal Land Banks *6)*. Melton nonetheless predicted a new era of agressive farm mortgage lending by life insurance ompanies.

t has also been suggested that the declining market share for life insurance companies is attributble to competition from Federal Land Banks. hanges in the 1971 Farm Credit Act and adoption of a variable interest rate are sometimes cited as factors which allowed Federal Land Banks to obtain a greater market share. However, after analyzing these factors, Robison and Love conclude that:

> The most plausible explanation for market share changes was internal life insurance company rationing of funds. This resulted from increased demand for policy loans, improved investment opportunities in nonfarm investments, and usury laws which may have restricted their ability to compete for loan funds (*7*, p. 29).

The growth in demand for farm mortgage loans relative to the growth in investible funds at life insurance companies has also influenced market shares. From 1970 to 1980, the amount of farm real estate loans outstanding increased at a compound annual rate of 11 percent, while total assets of life insurance companies increased at a compound annual rate of only 9 percent *(1)*. Under these conditions, life insurance companies would need to invest an increasing proportion of their funds in farm mortgages to maintain even a constant market share. For example, in 1965 life insurance com-

able 1—Distribution of year-end assets of U.S. life insurance companies, selected years, 1950-79

Year	Government securities	Corporate securities		Mortgages		Real estate property	Policy loans	Miscellaneous assets	Total
		Bonds	Stocks	Farm	Nonfarm				
					Million dollars				
950	16,118	23,248	2,103	1,327	14,775	1,445	2,413	2,591	64,020
955	11,829	35,912	3,633	2,237	27,172	2,581	3,290	3,742	90,432
960	11,815	46,740	4,981	2,982	38,789	3,765	5,231	5,273	119,576
965	11,908	58,244	9,126	4,823	55,190	4,681	7,678	7,234	158,884
970	11,068	73,098	15,420	5,649	68,726	6,320	16,064	10,909	207,254
975	15,177	105,837	28,061	6,753	82,414	9,621	24,467	16,974	289,304
979	29,085	170,037	39,456	12,207	106,557	13,047	34,781	26,283	431,453
					Percent				
1950	25.2	36.3	3.3	2.1	23.0	2.2	3.8	4.1	100.0
1955	13.1	39.7	4.0	2.5	30.1	2.9	3.6	4.1	100.0
1960	9.9	39.1	4.2	2.5	32.4	3.1	4.4	4.4	100.0
1965	7.5	36.7	5.7	3.0	34.8	3.0	4.8	4.5	100.0
1970	5.3	35.3	7.4	2.7	33.2	3.0	7.8	5.3	100.0
1975	5.2	36.6	9.7	2.3	28.5	3.3	8.5	5.9	100.0
1979	6.7	39.4	9.2	2.8	24.7	3.0	8.1	6.1	100.0

Source: *(1)*.

Table 2—Life insurance company farm mortgage loans by region and State, January 1980

Region and State	Farm mortgage loans	Market share
	1,000 dollars	*Percent*
Northeast	97,035	2.6
Maine	6,304	4.8
New Hampshire	5,357	19.2
Vermont	120	.1
Massachusetts	2,337	4.3
Rhode Island	0	0
Connecticut	368	.2
New York	22,678	2.2
New Jersey	4,652	1.7
Pennsylvania	35,164	2.8
Delaware	1,162	1.0
Maryland	18,893	3.3
Lake States	614,542	7.2
Michigan	69,791	3.7
Wisconsin	128,628	4.9
Minnesota	416,123	10.5
Corn Belt	2,758,549	14.4
Ohio	249,112	10.2
Indiana	466,104	14.0
Illinois	725,501	15.3
Iowa	876,893	15.1
Missouri	440,939	15.3
Northern Plains	1,312,735	15.1
North Dakota	60,405	4.3
South Dakota	125,847	9.1
Nebraska	664,543	21.9
Kansas	461,940	16.1
Appalachian	391,913	6.4
Virginia	39,828	4.1
West Virginia	12,456	5.9
North Carolina	119,303	7.8
Kentucky	150,600	8.2
Tennessee	69,726	4.4
Southeast	763,394	13.4
South Carolina	21,393	3.2
Georgia	201,278	10.4
Florida	458,348	22.8
Alabama	82,375	7.6
Delta States	1,187,141	25.3
Mississippi	382,277	26.3
Arkansas	448,876	24.4
Louisiana	352,988	25.6
Southern Plains	1,188,117	17.0
Oklahoma	224,795	10.6
Texas	963,322	19.7
Mountain	1,469,056	19.4
Montana	319,626	18.9
Idaho	239,729	15.5
Wyoming	140,968	24.3
Colorado	369,943	19.5
New Mexico	106,464	16.7
Arizona	191,212	30.3
Utah	23,422	6.5
Nevada	77,692	34.2
Pacific	2,374,822	22.2
Washington	406,387	22.6
Oregon	236,979	15.0
California	1,731,456	23.7
48 States	12,154,304	14.8
Alaska	0	0
Hawaii	11,075	11.5
United States	12,165,379	14.8

Table 3—Farm real estate debt distribution by lending group, selected years, 1950-80

Year beginning January 1	Total debt	Commercial banks	Farmers Home Administration	Federal Land Banks	Life insurance companies	Individuals and others	Total
	Million Dollars	*Percent*					
1950	5,579	16.7	3.6	17.3	21.0	41.4	100.0
1955	8,245	14.1	4.6	15.5	24.9	40.9	100.0
1960	12,082	12.5	5.6	19.2	23.2	39.5	100.0
1965	18,894	12.8	6.8	19.5	22.7	38.2	100.0
1970	29,183	12.2	7.8	19.6	22.9	37.5	100.0
1975	46,288	12.9	6.9	29.0	13.6	37.6	100.0
1980	82,123	10.5	8.0	36.1	14.8	30.6	100.0

panies held 22.7 percent of total farm mortgage loans by allocating 3 percent of their total investments. By the end of 1979, life insurance companies would have needed to allocate 4.4 percent of their investments to farm mortgages to capture a market-share comparable to the 1965 rate. A heavy demand for policy loans and the opportunities in other investments precluded allocation of an increased proportion of investments to farm mortgages.

In assessing the future role of life insurance companies, Farm Credit System analysts conclude that: "The future role of life insurance companies in farm mortgage lending will probably decline because of a prospective slowdown in the growth rate of lendable funds" (*3*, p. 111). During the seventies, lendable funds grew at an annual compound rate of approximately 9 percent. Hughes projects an 11-percent annual compound rate of growth in farm real estate debt for the eighties.[2] Unless lendable funds of life insurance companies increase dramatically or the proportion of investable funds committed to farm mortgages increases significantly, a further decline in the market share of life insurance companies seems likely.

Sources of Funds

Premiums paid by individuals on insurance policies are the major source of investable funds for life insurance companies (table 4). Total premium receipts have historically averaged between 70 and 75 percent of total sources of funds. However, the composition of premium receipts has changed greatly.

Life Insurance Premiums

Life insurance premiums accounted for over 55 percent of total sources of life insurance company funds in 1950, but only about 34 percent by 1978. The relative decline is attributable in part to a growing disenchantment by policyholders in whole-life insurance. For example, Loomis contends that:

> In an age of inflation, whole-life insurance is almost a caricature of the kind of product a buyer should wish to avoid: it is a long-term promise to pay, denominated in fixed dollars; it develops savings, in the form of "cash value," on which a policyholder earns only low rates of interest; and for all these wonderful things, the buyer gets to pay extra, laying out much more per dollar of insurance than he would if purchasing the main alternative product, term insurance, which includes no savings feature. (*4*, p. 87).

The growth rate in the purchases of term insurance has far exceeded that of whole-life insurance. However, as there is no "savings" feature in term insurance, the relative share of all funds provided by life insurance premiums has declined over time.

The future prospect for whole-life insurance is dim. Schwarzschild points out that the high frontend load (the commission on whole-life policies is a high percentage of the first year's premium with little cash surrender value) will not be tolerated by the public *(10)*. Likewise, Schwarzschild believes that higher yields at competing savings institutions and trends toward higher divorce rates, smaller families, greater Social Security benefits, and greater welfare benefits have all reduced the need for life insurance coverage. Unless major modifications are made, a continuing decline in the relative share of the life insurance dollar coming from life insurance premiums is expected.

The insurance industry is developing life insurance products designed to increase rewards to savers. One such product—complete life insurance—offers a fixed rate of interest on savings plus an additional rate based upon market rates of interest. Such new products will bring in additional funds, but they will not be low-cost funds on which the insurance companies can make large investment profits.

Annuity Considerations

In recent years, annuity considerations have been the fastest growing source of funds for insurance companies. The percentage of all life insurance company funds obtained by annuities increased from 7.6 percent in 1970 to 15.1 percent in 1978. The increase largely reflected investments made by group pension plans.

The future of annuity considerations as a source of funds appears bright. As life expectancy increases, people have a growing need to supplement Social Security benefits with private pension plans. The impetus for pension plans has come largely from businesses who have offered pension plans as a part of a fringe benefit package. However, there is also a growing demand for individual retirement plans, such as Keough plans and individual retirement accounts.

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[2] See the first article in this issue.

Health Insurance Premiums

The percentage of total funds coming from health insurance premiums increased from 8.8 percent in 1950 to 23.9 percent in 1978. The rapid increase mirrors the growing cost of medical services as well as the desire by some companies to expand product lines. Growth in group health insurance plans is responsible for much of the increase. As with annuity considerations, the desire of businesses to maintain or improve fringe benefit packages is largely responsible.

Unlike annuity considerations, health insurance payments are high relative to health insurance premiums. For example, in 1978 the ratio of health insurance payments to health insurance premiums was 0.73; whereas, the ratio of annuity payments to annuity receipts was 0.32. This ratio implies that health insurance premiums have a quick turnover, and investments of such premiums are most likely to be in short-term, highly liquid assets. Hence, future growth in health insurance premiums is not expected to have a major impact on the availability of funds for long-term investments such as farm mortgages.

Investment Income

Investment income as a percentage of all funds for life insurance companies has increased in recent years and now accounts for over 20 percent of all sources of funds. The increase mirrors not only the inflation-induced increases in interest rates on Government securities and bonds, but a conscious effort on the part of companies to shift the investment portfolio toward higher yielding investments (table 1).

Investment income is expected to remain an important source of funds for life insurance companies. However, if there is a shift away from savings-type products purchased from life insurance companies (for example, whole-life policies or pensions and other annuities), then the relative importance of investment income would likely fall. Alternatively, higher inflation rates, coupled with a growth in annuities, would likely increase the relative importance of investment income as a source of funds.

Table 4—Source of funds for U.S. life insurance companies, selected years 1950-78

	Premium receipts						
Year	Life insurance	Annuity considerations	Health insurance premiums	Total premium receipts	Investment income	Other income	Total income
				Million dollars			
1950	6,249	939	1,001	8,189	2,075	1,073	11,337
1955	8,903	1,288	2,355	12,546	2,801	1,197	16,544
1960	11,998	1,341	4,026	17,365	4,304	1,338	23,007
1965	16,083	2,260	6,261	24,604	6,778	1,785	33,167
1970	21,679	3,721	11,367	36,767	10,144	2,143	49,054
1975	29,336	10,165	19,074	58,575	16,488	2,959	78,022
1978	36,592	16,339	25,829	78,760	25,294	4,152	108,206
				Percent			
1950	55.1	8.3	8.8	72.2	18.3	9.5	100
1955	53.8	7.8	14.2	75.8	16.9	7.3	100
1960	52.2	5.8	17.5	75.5	18.7	5.8	100
1965	48.5	6.8	18.9	74.2	20.4	5.4	100
1970	44.2	7.6	23.2	75.0	20.7	4.3	100
1975	37.6	13.0	24.5	75.1	21.1	3.8	100
1978	33.8	15.1	23.9	72.8	23.4	3.8	100

Source: *(1)*.

Future Investment of Funds

Historical patterns of investment by life insurance companies were illustrated in table 1. Changes over time are readily apparent. Will the direction and pattern of such changes continue? Schott suggests that, "Life insurance investment policy is about to undergo the most radical change of our lifetime" (*8*, p. 23).

Much of the change in investment policy Schott suggests is a direct result of the high inflation experienced since the late seventies.

Equity Investment

In an attempt to "beat" inflation, life insurance companies are more likely to seek investments which are perceived as a good hedge against inflation. Equity investment in farm real estate is an example. Several life insurance companies have quietly acquired some farmland, primarily some large farming operations in Southern States. Special accounts held for pension funds are the most likely source of funds for such investments. Although the current return may be low relative to other investment options, long-term appreciation of pension fund assets is the desired objective.

There are also some points between full equity ownership of assets and the no-equity, strict mortgage position. For example, insurance companies may move toward joint ventures wherein they provide part of the equity capital as well as the mortgage funds. Alternatively, they may seek a share of the income or asset appreciation in operations where they are providing the mortgage funds. While joint ventures and the kinds of participations just described are not now common, past inflation has led major insurance companies to consider such investment policies. Continuation of high inflation will likely make such investment options more attractive.

Common stocks have been the major equity investment of life insurance companies. However, through much of the seventies, stocks were not an effective hedge against inflation. Whether stocks should now be viewed as an inflation hedge is a matter of debate in many companies.

Liquid Assets

The liquidity crunch of early 1980 created a greater appreciation of the need for and benefits of highly liquid short-term investments. A combination of heavy policy-loan demand, high mortgage commitments, and withdrawals of pension funds left most companies scrambling for money. Furthermore, the inverted yield curve (short-term rates exceeding long-term rates), which existed during part of the seventies, created periods when returns for short-term investments were higher than for long-term investments with fixed interest rates such as farm mortgages. Consequently, short-term liquid assets are likely to become a more important component in the future investment portfolio of life insurance companies.

Long-Term Bonds and Mortgages

Long-term bonds and mortgages with fixed interest rates have been an important investment for life insurance companies. However, in the face of rapidly rising money rates, fixed interest rates have created an unfavorable position for these traditional long-term instruments. Several changes may occur. First, life insurance companies may shift their portfolios in favor of other investment options. Second, the terms of mortgages and bonds may be altered to allow for adjustments to the instability in financial markets. For example, shorter maturities with renegotiation of interest rates at maturity or variable rates tied to short-term money market rates would likely make bonds and mortgages less susceptible to fluctuating interest rates. It is likely that life insurance companies will move rapidly in that direction.

Farm Mortgage Terms and Lending Procedures

Farm mortgages are an important component of the investment portfolio of life insurance companies. Changes in the sources of loanable funds and the need for liquid assets have a direct bearing on the terms of farm mortgage loans.

Farm Mortgage Terms

Life insurance companies have in the past offered farm mortgage loans with fixed interest rates and a relatively long amortization schedule, but with balloon payment after 10 to 20 years.

However, Meinhold suggests that:

> It is almost a certainty that, in an inflation-oriented economy, loan terms will tend to be shorter and variable rates will become more standard *(5)*.

This sentiment is echoed by Douglas who says:

> Presently, the term of our (farm mortgage) loans range from 10 to 20 years. We are pushing for shorter term loans currently, and in the future, will take a hard look at the use of variable rates *(2)*.

Schwab only partially agrees:

> I don't believe insurance companies will go to variable rates, but I believe they will have some method of reviewing the rate each 3 to 5 years by either calling the loan or having some form of renegotiation of the rate. Such a plan would necessarily allow the borrower to prepay the loan without penalty if he did not accept the rate the insurance company proposed and would probably give the insurance company the right to call the loan if the rate could not be agreed upon *(9)*.

Thus, future farm mortgage contracts will likely have far shorter maturities (some suggest 3-5 years), and some will likely have variable interest rates. This change will move life insurance farm mortgage loans closer to the variable rate loans now offered by Federal Land Banks. The main difference may be the maturity of the loan. Even with a 3-5 year maturity, the amortization schedule used by life insurance companies will not likely change; only the balloon payment will be larger. Farm borrowers may be concerned about the possible failure to renew the balloon portion, so contracts will likely be written to provide for an automatic renewal at the prevailing rate of interest, provided payments have been made as scheduled.

Some insurance companies are also investigating the use of shared appreciation mortgages (SAM's). A SAM works in this manner. In exchange for a fixed interest rate below current market rates, the borrower agrees to give a percentage of the capital gains on the land to the lender. For example, if market interest rates are 14 percent, the lender may agree to a 10-year loan with a fixed interest rate of 11 percent in exchange for 30 percent of the capital gains on the asset being financed. If not sold at the end of 10 years, the asset would be appraised and 30 percent of the gains would be due the lender, either as a lump sum payment or more likely as an increase in the loan balance.

Lending Procedures

Life insurance companies obtain and service farm mortgage loans through field representatives (direct employees of the company) and through farm mortgage correspondents (contacts who are not direct employees of the company). Correspondents will likely become more multicompany oriented as individual companies may be in or out of the market on short notice. Survival dictates that correspondents have ready access to loanable funds. The use of multicompany correspondents is likely to increase if life insurance companies continue to be in and out of the market for farm loans. Field representatives cannot easily be sustained if they face extended periods of restricted funds for farm mortgage loans. Correspondents, however, offer a "quick" way to get in and out of the market.

Although numerous life insurance companies engage in farm mortgage lending, only a few companies dominate the market. Five companies account for about 75 percent of the total farm mortgages provided by life insurance companies. These few companies will likely continue to dominate the market. Thus, the market share of life insurance company loans could change rather dramatically if only one of these major companies decided to alter significantly its portfolio against farm mortgage investments. However, farm mortgages have been a profitable investment and no dramatic shift away from farm mortgages by the major companies is anticipated.

Conclusions

The life insurance industry is undergoing striking changes, primarily as a result of the country's high inflation rate. Changes are occurring in liquidity management strategies, sources of funds, investment strategies, the types of products offered by the life insurance industry, and the terms and conditions under which mortgage funds are made available to borrowers.

Events of early 1980 demonstrated the need for maintaining a large balance of liquid assets. Life insurance premiums, as a percentage of all sources of funds for life insurance companies, have declined while annuity considerations have increased. Investment strategies have been modified to better protect pension deposits against inflation. The length of farm mortgage loans (as a means to renegotiate interest rates) has been reduced. All these changes have been designed to stabilize the life insurance industry in the financial community. And, although critics claim the changes have come too slowly, changes are occurring.

For farm firms who deal with life insurance companies, both as policyholders and as borrowers, the changes create new opportunities and challenges. Policyholders may have greater options for inflation-protected investments. For farm borrowers, changes in the terms and conditions of farm mortgage contracts offered by life insurance companies may well modify financial risk. Variable interest rates, or rates renegotiated at 3-5 year intervals, make the cash flow requirements for the purchase of land far less certain than the fixed interest rate contracts. Financial risk is thereby increased. In contrast, the development of equity and/or income participation could well reduce the variability in cash flows and the growth in equity capital.

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Noninstitutional Lenders in the Agricultural Credit Market

By Michael Boehlje*

Abstract

Noninstitutional lenders have been an important source of funds for farmers. Major sources of noninstitutional funds include merchants and dealers, personal loans and loan guarantees, and installment land contracts. In general, as noninstitutional lenders are partially residual claimants, the volume of noninstitutional credit will depend on the ability of institutional lenders to serve future credit demand at reasonable rates and profits. Rising interest rates are expected to encourage interfamily loans and land contracts among family members, but to discourage merchants and dealers from extending credit unless it is needed as a sales promotion tool.

Keywords: Merchant-dealer, Credit, Installment land contracts, Personal loans, Corporate debentures, Second mortgage, Agricultural credit

Introduction

In this article, I first review the volume and market share of farm real estate and nonreal estate credit provided by noninstitutional lenders. I consider the three major arrangements they use when making loans to farmers: installment contracts for the purchase of real estate, personal loans and loan guarantees, and the credit programs of merchants and dealers. I also review the expected use of these arrangements in the future.

The loan terms, legal characteristics, and policies and procedures of noninstitutional lenders vary widely; for most, extending credit is not a primary business activity. Consequently, it is difficult to generalize about the future role and activity of noninstitutional lenders. In addition, the heterogeneity of the lenders involved and the limited historical data on past trends make it difficult to predict changes in the volume and terms of noninstitutional credit for farmers. The lack of data also makes the role of noninstitutional lenders an extremely difficult and complex research area.

Volume and Trends

Noninstitutional lenders are active in both the farm real estate and the farm nonreal estate credit markets.

Real Estate Credit

The proportion of farm real estate debt held by noninstitutional lenders has been consistently high over the years. However, the market share declined from 39.2 percent in 1960 and 37.5 percent in 1970 to 36.6 percent outstanding on January 1, 1980—less than one-third of the market *(3)*.[1]

A major part of the noninstitutional lender real estate debt is held by individuals, mostly by those who have sold their farms using a mortgage, deed of trust (where a limited power of sale over property is placed in one or more trustees by deed to secure payment of money and performance of other conditions) *(1)*, or a purchase contract (also called a sales contract, installment land contract, or contract for deed). In the year ending March 1, 1980, sellers nanced 38 percent of the credit-financed farmland ransfers, including 25 percent financed using a purhase contract, and 13 percent using a mortgage *(4)*. eller financing of farmland transfers is far more redominant in the Mountain, Lake, and Pacific tates where it accounted for 60, 55, and 54 perent, respectively, of the credit-financed farmland ransfers in 1980. In contrast, only 19 percent of armland transfers were seller-financed in the Delta tates *(4)*.

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[1] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

onreal Estate Credit

oninstitutional lenders held 15.6 percent of the onreal estate debt outstanding to farmers on anuary 1, 1980 *(3)*. Historically, these lenders have rovided a large proportion of the nonreal estate redit used by farmers. However, their share has eclined substantially since the midsixties when hey held almost one-third of the nonreal estate ebt outstanding. This decline in noninstitutional ending may be partly due to improvements in the uality and competitive price of loan services ffered by institutional lenders.

sample survey taken as a supplement to the 1969 *ensus of Agriculture* provides the latest detailed nformation available on the number of farms eporting nonreal estate debt from various types of enders. Although more current data would be useul, the results of this survey suggest that even hough the aggregate volume of noninstitutional redit has declined, such credit is still utilized on a arge proportion of U.S. farms. Of the farms reportng, 46 percent reported debt owed to merchants nd dealers, 7 percent reported debts to "other inividuals" (relatives, friends, estates, and others), nd 8 percent reported "unpaid bills" (for veterinary ervices, utilities, past due taxes or insurance preniums, and debts for other purposes relating to the arm). For comparison, 52 percent of the farmers eported they owed debt to commercial or savings anks *(5)*.

1971 sample survey by geographic region shows hat merchant and dealer credit remained relatively mportant in the South, where it once was the prelominant form of operating credit used by farmers. n the eastern South Central States, merchant and lealer financing comprised 22 percent of the total onreal estate debt reported. The percentage was lso relatively high in the western South Central, ew England, and Middle Atlantic States. The lowest percentage was in the western North Central States where only 10 percent of the nonreal estate debt was held by merchants and dealers *(5)*. Differences in the lending services offered by institutional lenders in these regions may again account for these geographic differences.

Installment Contract Sales

The installment contract sale is a popular method of financing real estate transfers. With the contract sale, the buyer obtains possession of the property in return for making a downpayment and executing a contract for the remaining amount of the purchase price. The seller finances the transaction and typically retains the deed or legal title to the property until all contract payments have been made.

One of the arrangements frequently used with installment sale contracts is the combination of partial amortization over a period of time and a balloon payment. For example, the contract might call for a 29-percent downpayment and the payment of an additional 31 percent of the principal plus interest over a 10-year period, with a balloon payment at the end of the 10th year of the remaining 40 percent of the purchase price. This procedure makes it possible to keep the annual payments on the contract relatively low, thus enabling the buyer to purchase the real estate without as large a cash subsidy from sources other than the land itself. At the end of the tenth year, the buyer has usually obtained enough equity to refinance the property and make the balloon payment using a third-party mortgage.

The advantages and disadvantages of using the installment contract sale are numerous. From the seller's viewpoint, the low downpayment that is typical with the contract may increase the number of potential buyers. The contract payments provide a steady flow of income that will not be reduced in amount or value during periods of deflation, and they can typically qualify for installment reporting of gain for tax purposes. Although the low downpayment may increase the risk of buyer default, the seller can frequently regain ownership within a relatively short period—possibly 30 days—depending upon the forfeiture or foreclosure provisions under State law. A major disadvantage to the seller is the reduced liquidity and the fact that the contract does not adjust with inflation.

Buyers who use a contract can usually purchase real estate with a lower downpayment than with a conventional mortgage sale. In addition to building equity in the real estate, such buyers also have a better security of tenure compared with renting the land. However, a buyer who defaults may lose possession of the farm very quickly. In addition, the annual payments on the contract may be high compared with the income from the land. If the balloon payment arrangement is used, later refinancing may be required at higher interest rates. Although the following discussion of the installment sale contract emphasizes its tax advantages, there are many other advavtages as well as disadvantages.

Installment Reporting of Gain

Under Internal Revenue Code provisions, sellers of property can spread any capital gain over the life of a contract rather than report the gain for tax purposes in the year of sale. Sellers can delay tax payments and spread out the gain over many years, rather than reporting it all in one year and being taxed in a higher marginal tax bracket. If the seller uses this installment treatment of gain, the annual contract proceeds are reported partly as interest taxed at ordinary income rates, partly as recovery of capital (and thus not taxed), and partly as capital gain. If this gain is a long-term capital gain (which is typically the case with real estate), then 40 percent of it is reported as income and taxed at the ordinary income tax rates.

Because of the incentives for the seller to use a contract with a low interest rate (and thus higher price per acre) to convert ordinary income into capital gain, the installment payment of tax provisions included an unstated interest rule. Essentially, this rule specifies that if the interest rate on an installment contract is below the "test rate," it will be recomputed at a higher rate and the interest received by the seller will be taxed as ordinary income at this higher rate *(7)*. For contracts entered into on or before July 24, 1975, the test rate is 4 percent and the rate is recomputed at 5 percent compounded semiannually; for contracts negotiated on a later date, the test rate is 6 percent and the recomputation rate is 7 percent compounded semiannually *(10)*. Proposed regulations would increase the test rate to 9 percent and the recomputation rate to 10 percent compounded semiannually.

Prior to October 1980, for a contract to qualify for installment reporting, the contract payments in the year of sale could not exceed 30 percent of the selling price *(6)*; and the payments had to be spread over at least 2 taxable years and involve two or more payments *(9)*. Recent legislation dramatically altered these rules and the qualifications for reporting gain on an installment basis *(2)*. The legislation eliminated the 30-percent limit on the down payment and the 2-year, two-payment requirement. It also restricted the potential for a seller to report the gain on an installment basis if the buyer is related to the seller and sells or transfers the property to a third party—thereby obtaining the same family liquidity as could be obtained in a cash sale. If such a transaction occurs within 2 years after the original sale, the original seller must report any remaining gain and be taxed thereon at the time of the subsequent sale. The legislation also changes the tax treatment of the property when a buyer on contract inherits the contract obligation at the death of the seller. This frequently occurs with contract sales between family members. In essence, the new provisions no longer allow the contract to be inherited tax free; thus, the remaining untaxed gain is taxed to the estate and an income tax must be paid in addition to the estate tax.

The additional flexibility in setting up the contract terms allowed by this new legislation may marginally increase the use of the installment contract arrangement. However, eliminating the 2-year rule will have little if any effect since most contracts for farmland have a maturity in excess of 2 years. Eliminating the 30-percent limit on the down payment is expected to have more effect, but in the past many contracts—particularly between family members—required less than 30 percent down to accommodate the buyer's cash position as well as to qualify for installment reporting of gain. Also, larger downpayments may reduce the number of potential buyers for the property. The changes in tax treatment when a contract is inherited by the purchaser and the potential increase in income tax liability may, in fact, discourage older landowners—who may die before the contract obligation has been paid off—from selling on contract to family members. These changes in tax law thus are not expected to dramatically increase the use of the installment contract in financing farm real estate transactions.

Contract Terms

Innovation in contract terms can be expected in the future. Variable interest rates that reflect changes

money market conditions may become more
opular; interest rates might originally be set below
e Federal Land Bank or some other market rate,
ut then fluctuate with changes in this market rate.
elayed or variable payment schedules may be
sed, particularly among family members where the
eller has other sources of income. Some sellers
ay offer reverse-annuity repayment schedules
here the payments increase over time but are less
an the interest obligation during the early years
d the unpaid interest is added to the outstanding
an balance. Others may offer options for the
uyer to delay a payment, (for example, in 1 year
ut of 10) to reduce the risk of default in years of
w cash income.

he installment contract undoubtedly will continue
be a major source of financing for the transfer of
eal property. However, even with innovations in
erms of variable interest rates, the contract ar-
angement still does not provide a good inflation
edge for the seller. One method for a seller to dis-
ose of real property, yet maintain a hedge against
flation through the ownership of real estate, is
hrough use of a like-kind exchange *(8)*. This ar-
angement allows owners to trade their real prop-
rty for other "like-kind" property having the
esired management, income, and appreciation char-
cteristics, but without incurring a capital gains
ax. If inflation continues and real property con-
nues to be a "good" inflation hedge, exchange ar-
angements may be used more frequently than con-
ract sales. Or, other types of arrangements may be
eveloped whereby the seller receives a percentage
f the increase in value during the life of the con-
ract (an "equity kicker") in addition to receiving
he annual payment.

n summary, the contract arrangement appears to
ccomplish a number of the functions typically per-
ormed by financial institutions in converting the
ime, place, size, maturity, and risk characteristics
f savings into a form compatible with what in-
estors also want. The savers (sellers) and investors
ouyers) concur as to the time and place character-
stics of the funds. The size characteristic (that is,
he amount of the loan) is also compatible since
ellers have the entire proceeds of the property
ale to invest (the only source of disagreement may
e the size of the downpayment), and it is not neces-
ary to aggregate the funds from a number of
avers to obtain an adequate size loan. Sellers are
requently not interested in liquid short-term in-
estments, but instead prefer longer maturity
assets that will generate income during the retirement years; this is compatible with the maturity that buyers want. Finally, the risk characteristics of the contract arrangement may be somewhat incompatible—sellers may want a savings instrument with less risk than contract purchases can normally offer. However, the land provides the security interest for the contract agreement, and land has been excellent collateral for financing arrangements in the past. Furthermore, as some States have developed forfeiture procedures which enable the seller to obtain possession of the land quickly and with a minimum of legal procedures if the buyer defaults, the seller's risk is reduced compared with a conventional mortgage which must go through foreclosure proceedings upon default.

The Second Mortgage

An additional development in real estate financing that is being used in the urban (and to a limited extent in the rural) real estate market is the second mortgage. As commonly used, the seller of the property accepts the equity in the form of a second mortgage as part of the sale arrangement rather than receiving the entire equity as cash. The buyer then assumes responsibility for annual payments to the holder of the first mortgage (frequently a financial institution) as well as to the seller who holds the second mortgage. Such arrangements are used to reduce the size of the downpayment required to purchase the property as well as to transfer a first mortgage with favorable terms to the buyer if the mortgage is assumable. A similar arrangement called a wrap-around mortgage, where the holder of the second mortgage (typically a financial institution or a third party) accepts the responsibility for making the payments on the first mortgage, can also be used to take advantage of a favorable interest rate on a first mortgage.

These mortgage arrangements may become more common in financing farm real estate transfers when current market interest rates are substantially higher than the fixed rate on an outstanding mortgage. However, with an increasing proportion of farm real estate loans made on a variable-rate basis where the advantage to the buyer of assuming the loan is minimal, and with the availability of installment contracts where downpayments are low compared with conventional financing, second and wrap-around mortgages are not expected to expand dramatically.

Personal Loans and Loan Guarantees

The terms and arrangements used for financing personal loans to farmers are not well documented. In most cases, personal loans are used because the borrower cannot qualify for a loan from a commercial lender or because the terms are very favorable (by design) for the borrower. Many such loans are obtained from family members or friends; consequently, interest rates and repayment schedules are usually not made public. However, it appears that many such loans are unsecured, and evidence provided by installment contracts between family members in the real estate market suggests that interest rates are probably below market rates. Repayment schedules and default risk are also expected to be different for personal loans compared with credit arrangements with commercial lenders. Recent changes in tax laws to exclude up to $200 of interest income from taxable income may marginally affect the use of personal loans in agriculture, but the change in the tax rules is not expected to have a major impact since most personal loans are intrafamily arrangements where after-tax return is not the primary objectve. Such intrafamily extensions of credit may become more common if agricultural incomes decline and commercial lenders perceive that the risks are too high in the farm sector.

The Debenture

A form of personal loan that may be used increasingly to finance farm firms is the family debenture. This financing arrangement can be used along with the corporate structure to facilitate the intergenerational transfer of the farm firm. When farmers contribute assets to a corporation, they can take back stock or a combination of stock and debentures. Debentures are debt instruments with a specified life (usually 10-15 years) and interest rate. The interest must be paid annually even if the corporation loses money, and interest payments are tax deductible to the corporation.

A corporation (either subchapter S or regularly taxed) capitalized with a combination of stock and debentures can simultaneously satisfy the goals of business continuity and estate and retirement planning. The interest payment on the debentures must be made, so the debenture holders (usually retiring parents) have a guaranteed income as long as they own the debentures. The interest payments are tax deductible to the corporation; but dividends, which may be an alternative source of retirement income, are not.[2]

Debentures can be particularly useful in estate planning when the family includes on-farm and off-farm heirs. The owners of the debentures have no management control because of the debt nature of debentures. Consequently, at the death of the parents, the on-farm heir can receive the stock and have controlling interest and management authority and responsibility for the corporation. The off-farm heirs can be given the debentures which have no management control but generate an annual return in the form of interest. Since the debentures have a specified maturity, the off-farm heirs cannot force the corporation and the on-farm heir to redeem them for cash until they mature. Thus, the on-farm heir obtains control of the corporation and need not pay out the off-farm heirs in cash immediately, but the off-farm heirs receive an annual return on their inherited capital. If such arrangements are used to encourage nonfarm heirs to leave their investment in the corporation, intrafamily debt will be substituting for external debt, which will affect the amount of institutional credit needed to refinance each new generation of farm ownership.

Loan Guarantees

Loan guarantees are not a direct source of financing, but they are a common substitute for personal loans between family members. Essentially, the loan guarantee (often also called an endorsement or cosignature) provides additional security so the borrower can obtain debt funds from commercial institutional lenders. If the borrower defaults on the loan, the endorser guarantees that payment will be made. Such arrangements are commonly used to enable beginning farmers with limited physical security to obtain credit.[3] Although aggregate statistics on loan volume and credit extension include such loans as institutional credit, little risk is

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[2] Retirement-age farmers could receive income during retirement years in the form of a salary from the corporation or earnings in a sole proprietorship, but such salary or earnings are considered earned income under Social Security rules and would probably result in payment of Social Security taxes and reduce the potential Social Security retirement benefits. However, interest paid on debentures is not earned income, so full Social Security benefits can be received.

[3] The loan guarantee arrangement is also used by the public sector to encourage private-sector lenders to make loans to firms normally considered as unqualified because of high risk.

orne by the financial intermediaries if the bor-
owers should default. The guarantors bear the risk
nd the contingent liability may affect their ability
o obtain debt funds for their own needs. The real
inancial risk of farmers and the farming sector may
e somewhat understated if much of the institu-
ional credit provided to certain farm operators (for
xample, beginning farmers) is guaranteed by other
armers (the parents in this case). Documenting the
xtent of this contingent liability would be useful to
hose assessing the financial risk in agriculture.

erchants and Dealers

n individual merchant or dealer may have several
bjectives when offering credit to customers. These
clude:

(1) Providing customers with a convenient and relatively simple way of financing purchases. Generally, customers need not formally negotiate terms of the loan nor go to a separate lender for funds.

(2) Promoting sales and meeting competition. Sales financing provides dealers with one method of differentiating their product from that sold by a competitor. A less restrictive credit policy may increase a dealer's sales volume in the same manner as lowering product price.

(3) Reducing the seasonality of sales. By offering credit to induce purchases in advance of the peak season, merchants can use their labor force and inventory facilities more efficiently.

(4) Promoting increased sales to reduce per-unit fixed costs. Retailing some types of supplies calls for large fixed investments relative to operating costs. When sales are increased through successful credit programs, a merchant's average fixed costs are reduced and per-unit profit margins are increased.

(5) Earning additional revenue from the finance charges customers must pay to obtain credit. However, a poorly managed firm could lose money on a credit program by failing to take in enough revenue to cover associated costs.

Surveys of merchants and dealers reveal that "maintaining or increasing sales" and "convenience to buyers" are the two reasons most often given for providing dealer credit.

Types of Arrangements

Credit extended by merchants, dealers, processors, manufacturers, and other types of nonfarm business takes many forms. Moreover, a merchant may have a different form of credit arrangement with one customer than with another. When vertical integration is involved, funds provided by nonfarm businesses may be more in the nature of investments of equity capital in the farm venture than loans to the farmers.

Open-account credit is extended by many retailers, including some manufacturers who sell directly to farmers, when frequent sales are made for relatively small amounts. Customers are usually billed for each purchase, particularly when supplies are delivered to the farm and farmers are not present to pay for them. Open-account credit carried more than 30 days is customarily referred to as extended open-account credit.

Bank credit cards are offered by some merchants and dealers as alternatives to open-account and extended open-account credit. The merchants or dealers and bankers jointly decide on a line of credit for each farm customer and prepare appropriate identification cards and sales forms for use by dealers. The farmers may then charge purchases from dealers up to the maximum of their line of credit. Dealers deposit all credit card sales drafts daily at their participating banks, which credit the dealer's account with the amount of the drafts less a prearranged discount. The banks mail statements to the farmers monthly, quarterly, semiannually, or annually, depending upon their seasonal ability to pay, and assume responsibility for collection. Losses are shared by the banks and the dealers.

Such a plan has advantages for all concerned. While some expenses are incurred by the merchants or dealers, the costs of handling accounts receivable are eliminated. Losses from uncollectible receivables generally are lower, since bankers, who are specialists in credit analysis, participate in determining the line of credit. Dollars involved in accounts receivable are available to merchants or dealers immediately for use in the business. Farmers enjoy the convenience of ready credit and may also benefit because their credit limit was determined in part by bankers rather than solely by dealers who are naturally interested in sales. Bankers benefit by the increased business generated and the goodwill created in their communities. Given the advantages of this arrangement, one might expect it to be used more frequently as a substitute for the open account arrangement.

Formal written contracts such as promissory notes and conditional sales contracts are often used to secure sales of major items. Hard goods such as trucks, tractors, and machinery are normally financed in this manner by suppliers or manufacturers through distributor-dealers to assist in orderly marketing efforts.

Source of Funds

Merchants and dealers who extend credit to farmers must be financed themselves. Major sources of financing are local commercial banks, larger city banks, banks for cooperatives, and manufacturers. If the merchant or dealer is a cooperative institution with farmers owning shares, the financing is likely to come from a bank for cooperatives or a commercial bank. Other merchants and dealers will quite likely be financed by local commercial banks. Such arrangements include the credit card system discussed earlier as well as various types of "floor planning," particularly with machinery and equipment dealers. Under this arrangement, the banks purchase farmers' notes from dealers using various arrangements for potential losses, such as an endorsement, repurchase, or reserve plan.[4] If the merchants or dealers are large operators and use an extensive line of credit they may go directly to large city banks for their financing. Manufacturers may provide dealer financing for a wide variety of items, such as machinery and equipment, machine repair and overhaul, fertilizer, and feed. In such cases, manufacturers may obtain financing by retaining earnings, by sale of commercial paper and debentures in the national financial market, or by borrowing from large commercial banks.

Another device used by merchants, dealers, and manufacturers to finance customer purchases is to sell customer notes to finance companies or to establish subsidiary credit corporations. In the case of the subsidiary, the initial capital is ordinarily furnished by the parent firm and loan funds are obtained by selling commercial paper and debentures in the national financial markets and discounting customer notes with commercial banks or borrowing from them. Where the financing agency is organized by a farmer cooperative, it may obtain loan funds by borrowing from a bank for cooperatives.

As long as the risk and default rates are acceptable, funds should be readily available for merchant and dealer financing. However, because of the high administrative cost per dollar loaned and the higher risk, merchant and dealer financing will likely remain more costly than institutional credit. The passage of less restrictive State usury laws along with higher market rates of interest will likely result in higher interest rates on merchant and dealer credit in the future. With higher costs of funds, one might also expect the open-account period (the period during which no interest is paid) to be shortened to reduce the cost of this credit arrangement to the merchant or dealer. However, since merchant and dealer credit is used primarily as a sales tool, adjustments in terms from period to period will depend primarily on demand conditions for the input and competitors' responses. For example, even though credit costs were higher in 1980 than in past years, many machinery dealers offered an extended free credit period as a merchandising tool to encourage sales.

Conclusions

Overall, noninstitutional credit will likely remain an important source of financing for farmers. Noninstitutional lending is inversely related to institutional lending. If market conditions enable institutional lenders to charge competitive interest rates, generate reasonable rates of return, and have adequate funds to serve agriculture, then noninstitutional lending will decline in importance. If institutional lenders encounter difficulties servicing the needs of farmers, then noninstitutional lending—particularly personal and intrafamily loans—will increase in importance.

Generally, rising interest rates will encourage intrafamily loans and land contract sales among family members, but discourage merchants and dealers from extending credit unless it is needed as a sales promotion tool. Recent tax legislation that allows contract sales to more easily qualify for installment treatment of capital gains may encourage the use of installment contracts in the real estate market. Second and wrap-around mortgages may become more common in agriculture, but a dramatic increase in

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[4] For further information, see Lee, Warren, and others, *Agricultural Finance*, 7th ed., (Ames: Iowa State Univ. Press, 1980).

heir use to finance real estate transfers is not ex-
ected. As more farms incorporate and use deben-
ures (debt instruments) and stock in their capital
tructure, the use of intrafamily debt will increase.

nnovations in the delivery of credit services by
erchants and dealers, such as the aforementioned
redit card plans, are expected, but whether mer-
hant and dealer credit will account for an increas-
g or decreasing share of the total debt incurred
y farmers in future years will depend largely on
hether or not the input supply industry judges
hat credit is needed to stimulate sales. If farm in-
omes are sufficiently high to encourage institu-
onal lenders to aggressively expand their credit
xtension program, merchants and dealers will
ecome a less important source of credit. If more
redit card arrangements are developed, there may
e a shift in the source of funds for merchant and
ealer financing from finance companies and money
enter banks to regional and local banks.

dditional data are needed for better evaluation of
hanges in trends and volumes of noninstitutional
redit for farmers. Periodic surveys such as those
one in the sixties may be useful; descriptive infor-
ation on characteristics of farmers using merchant
nd dealer credit and their reasons for using this
ource of financing would help us understand and
redict the future role of this source of funds for
armers. Better information on the use of loan
uarantees and the risks encountered by guaran-
ors may also be helpful. However, given the diver-
ity of noninstitutional lenders, the imperfections
n, or the lack of, a market in many cases (for exam-
le, in the case of intrafamily loans), and the many
oneconomic factors affecting the supply of and the
emand for funds from noninstitutional lenders, it is
ifficult to generalize about noninstitutional lender
ehavior and to project future volumes and trends
ccurately.

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The Farmers Home Administration's Changing Role and Mission

By William McD. Herr and Eddy LaDue*

Abstract

While FmHA's traditional farm ownership and operating loan programs continue to serve farmers not well served by commercial lenders, the newer emergency loans, now a major part of lending to farmers, serve borrowers whose characteristics more nearly fit into the commercial category. As emergency farm borrowers became the major FmHa farm clientele in the latter half of the seventies, the focus of the agency shifted from limited-resource farmers to one more competitive with commercial lenders. Although the future economic environment is uncertain, it is not likely that emergency credit programs will be needed on the scale provided in the last half of the seventies. Expansion of FmHA programs can further distort the allocation of credit within the farm sector and between the farm sector and other sectors of the economy. This study found no evidence that large groups of farmers are currently excluded from commercial credit and are, therefore, eligible for FmHA-type programs.

Keywords: Farmers Home Administration, Government farm credit

Introduction

Since its inception in 1946, the Farmers Home Administration (FmHA) has grown tremendously and has altered its original mission. The number of borrowers served annually has increased nearly threefold, and the dollar volume of funds loaned has increased many times. More important, what was once a farm lending agency has been transformed into one which has a majority of its activities in the nonfarm sector of the rural economy.

Our purpose here is to document and evaluate these and other changes and to examine the future role of FmHA in the eighties.

Historical Background

FmHA came into being in 1946 following a restructuring of the Farm Security Administration. In its early years, its activities were largely confined to supervising farm ownership and farm operating loans and to water facilities projects in the 17 Western States.

Subsequent legislation added housing loans for farmers (1949) and emergency farm loans for recovery from losses inflicted by natural disaster (1949). However, not until the midfifties was FmHA authority expanded to nonfarmers. In 1954, the Water Facilities Act expanded loans to all States and permitted water systems to take on nonfarm customers in rural communities. Legislation in 1961 extended the water system program to the rural population, including those living in towns of less than 2,500 persons. The Federal Housing Act was amended (1961), permitting FmHA to make housing loans to nonfarm rural residents, including persons living in towns of less than 2,500.

By the early sixties, FmHA had some experience with rural development. It had tested pilot programs of loans to small farmers who could not qualify for regular loans. Between 1964 and 1971, FmHA made nearly 65,000 economic opportunity loans to low-income, rural people for farm and nonfarm enterprises. And it aided communities by helping attract new industry and by providing community

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acility loans. Although FmHA was overwhelmingly farmer-oriented credit agency, the groundwork ad been laid through the rural housing and rural levelopment programs for an upsurge in FmHA ervices.

he transition from a farm lending agency to one hat services both farm and nonfarm customers ocurred as eligibility and loan authorities were roadened. Eligibility for FmHA rural housing oans was extended to those living in towns of nder 5,500, then to 10,000 (1971), and later to 0,000 (1976), that are outside Standard Metropolian Statistical Areas (SMSA's) and are certified by he Secretaries of Agriculture and of Housing and Jrban Development to lack mortgage money from ther sources. In some circumstances FmHA is able o make loans to families with low and moderate inomes in even larger communities.

lthough the expansion of FmHA's authority to nake housing loans in larger communities was the najor reason for the growth in this component of mHA's activity, many other changes contributed. Iousing programs for senior citizens, interest-suplement, rental assistance, and farm labor housing re some examples of activities which broadened he program and thereby contributed to the upurge in housing activity. Moreover, funding of the ousing program was changed from one of direct oans to one primarily of "insured loans" (1965). This change enabled the agency to finance housing rom the sale of closed loans and to lend out funds btained from loan repayments. In recent years, the gency has been empowered to guarantee some ousing loans made by commercial lenders.

Loans and grants in support of rural development nave also surged. First, waste disposal was added o the water facility programs (1965), and legislation raised the population limit on towns eligible for such loans to 10,000. Following enactment of the Rural Development Act (1972), FmHA activity for this purpose expanded even more. In 1977, FmHA was authorized to guarantee loans made by commercial lenders to rural businesses and industries located in cities up to 50,000 population. And it could make loans for community facilities, such as fire departments, hospitals, nursing homes, and public recreation facilities. In some cases, grants could be made for water, waste disposal, and certain other programs, including the improvement of rural industrial sites.

The results of these program additions have been substantial growth in the agency and its transformation from its initial farm orientation to one serving nonfarmers in rural areas. By 1967, FmHA was providing more loan funds annually to housing and rural communities than to farmers (fig. 1). By the early and midseventies, two-thirds of the annual dollar volume of new loans went to nonfarmers and about one-third to farmer programs. Expansion of emergency lending in the late seventies reversed this trend, and by 1979, farm lending made up more than half the total dollars loaned annually.

Including funds provided by FmHA's predecessors, the Resettlement Administration and the Farm Security Administration, $73 billion has been distributed by FmHA-type programs since 1935. Of this total, about 45 percent has been loaned to farmers; about 35 percent was for housing; and the remaining 20 percent was for community and business and industrial loans. Through fiscal year 1974, FmHA had loaned and distributed more total funds to farmers than to nonfarmers. Beginning in 1975, the cumulative total of loans and grants in its nonfarm programs exceeded the total provided through its farmer programs (fig. 2).

Impacts of Growth and Changed Emphasis

This growth and the transformation of FmHA to a nonfarm orientation has brought the agency substantial stress. With considerable justification, FmHA has pointed out a tremendous increase in its caseload per worker. Its total staff increased about 50 percent between 1967 (the first year its nonfarm lending activities exceeded farm lending) and 1979. Loan volume soared and the number of loans and grants made annually increased by over 70 percent, while the number of active borrowers at yearend increased more than threefold. The ratio of real dollars loaned per worker year, or the outstanding real dollars for which one person was responsible, increased 2.5 to 3 times between 1967 and 1979. And if one considers the number of loans and grants made per worker year, the caseload increased about 20 percent in this period *(10)*.[1]

Nevertheless, it is difficult to judge the seriousness of the increased caseload, as numerous other factors have also changed. For example, in recent years the agency was charged with delivering approximately

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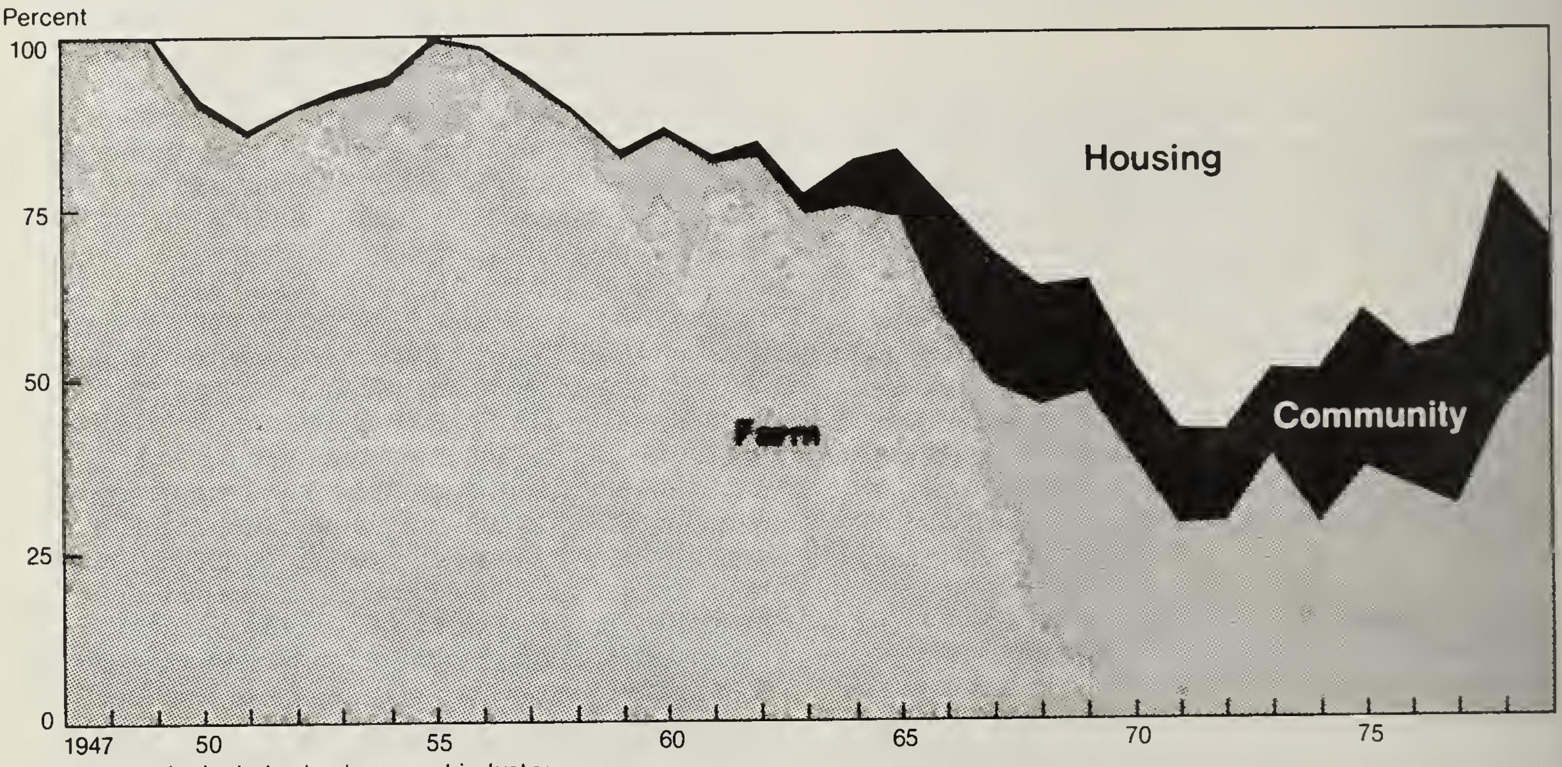
[1] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

Figure 1

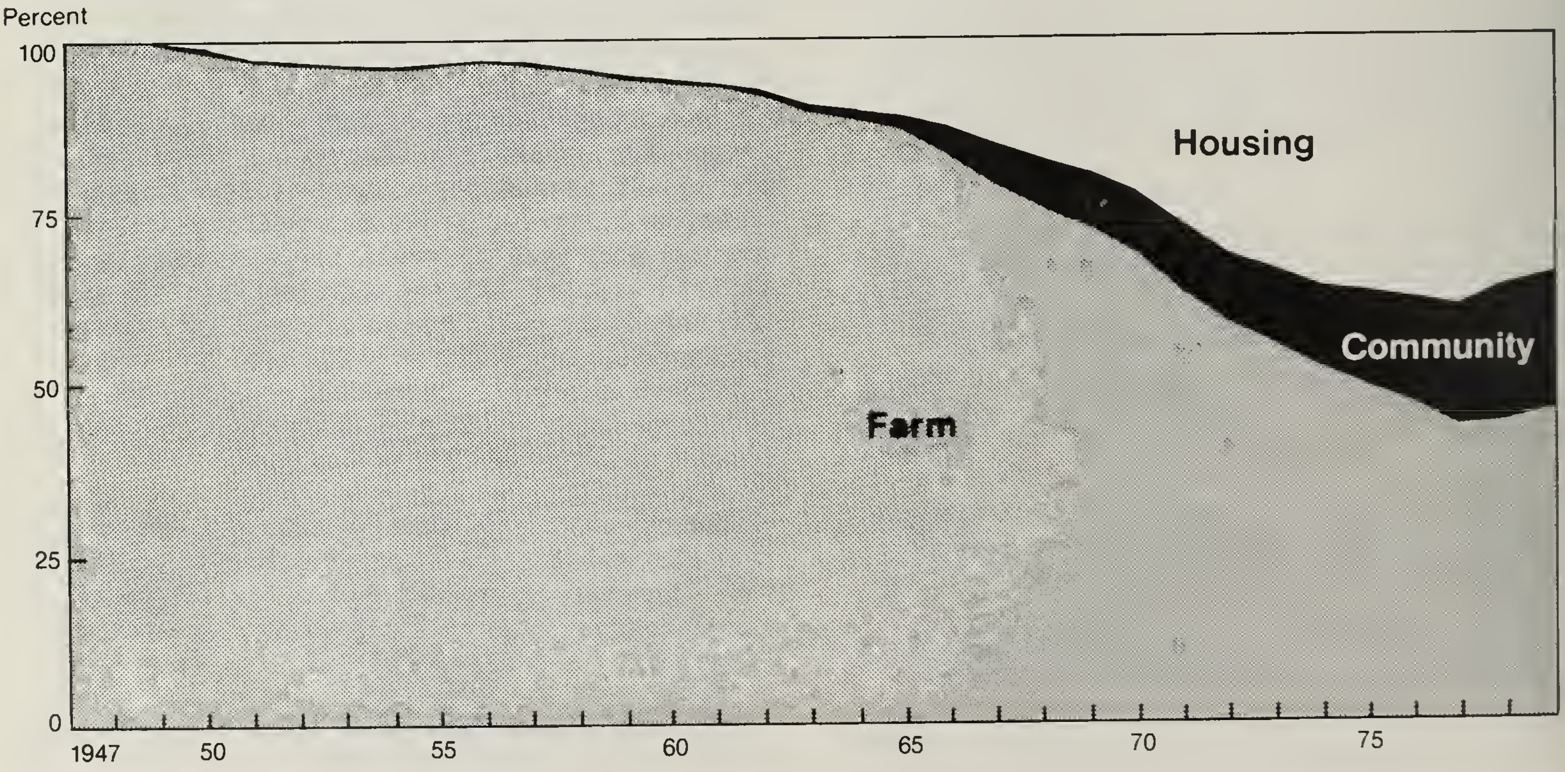
Percentage Distribution of Total Annual Dollars Loaned by FmHA



Community includes business and industry.

Figure 2

Percentage of Cumulative Dollars Loaned and Granted by FmHA



different programs to a tremendously varied ientele. Nine programs accounted for about 95 ercent of the total $14.7 billion in loans and grants ade by FmHA in fiscal 1979; 21 programs ac- ounted for the remaining 5 percent. The uneven stribution of loan activity among programs makes more difficult to handle the same load per worker formerly. However, computerization and growth the housing program, which is likely to have a ore standardized procedure, works in the direc- on of permitting a larger caseload per worker. pecialization and associated efficiency have been ncouraged by a reorganization which makes in- vidual farm and housing loans primarily the sponsibility of county offices, whereas multifamily ousing, community, and business and industrial ans are handled by district offices. These and her changes complicate any evaluation of the riousness of the caseload problem.

his problem has been discussed for several years. or example, during congressional hearings in early 976, Senator Richard Clark of Iowa said, “the eason that our subcommittee began to study the armers Home Administration two years ago was a irect result of our feeling that the Agency was rowing so fast with no corresponding personnel in- reases, that potential for serious problems was in- reasing” (*8*, p. 2).

ince the 1976 hearings, the number of FmHA orkers increased about one-fourth, but because of oaring loan volume, caseloads per worker con- nued to rise. This can cause a decline in the quali- of supervision and technical assistance, inade- uate attention being paid to an applicant's eligibili- , larger subsidy payments being made than may e required, and graduation not being encouraged early as possible. Inadequacies of this nature pro- ide support to critics of the agency who maintain at it is costly and provides credit to some who ould obtain it from commercial lenders.

a late 1979 hearing, the Assistant Secretary of griculture for Rural Development indicated that upervision and servicing had suffered as a result the greatly increased loan volume and a static ork force (*9*, p. 37). Although some borrowers ight prefer less involvement by FmHA in the echnical aspects of their operation, others believe at adequate supervision is needed to protect the overnment's interest and to foster sound financial ractices among marginal borrowers who compose ost of FmHA's clientele. The total cost associated ith a deterioration in credit supervision and service does not necessarily show up in the year a loan is made but later in the life of the loan. This adds to the complexity in judging the seriousness of the problem.

FmHA's traditional role of providing credit to those unable to obtain it from commercial sources has been further weakened by emergency credit programs containing forgiveness provisions and by programs channeling FmHA assistance to larger, more substantial borrowers than were previously eligible. The economic emergency loan program permitted FmHA to make loans up to $400,000 to farmers or ranchers who were hard pressed by shortages of credit from regular sources or by a cost-price squeeze. Such broad criteria are subject to wide-range interpretations. For example, there is no clear-cut definition of a credit shortage or of what constitutes a cost-price squeeze. Therefore, applicants not eligible for operating or ownership loans may be eligible for loans from this program. It seems likely that as more credit is extended under emergency programs, some FmHA personnel may gradually see less distinct boundaries between these and more traditional types of loan programs.

The agency's record of expanded activity to an increasingly varied clientele has affected farm and rural areas. Our analysis shows, however, that what the agency does in one program area can and does affect other programs, including the farmer programs. With fixed resources (for example, the number of employees), emphasizing one program area reduces the product and services in another program area. However, one should recognize that some complementary relationships also exist between programs. For example, to the extent that the expansion of housing and community programs provides for stronger local economies, these programs will likely benefit part-time farmers and those farmers seeking off-farm employment. Thus, understanding and analyzing FmHA's farmer programs apart from the rest of FmHA's activity is futile.

Farmer Loan Programs

The annual volume of credit extended by FmHA to farmers through all its farmer loan programs has expanded tremendously over the past 30 years despite its growing responsibilities in housing, community programs, and business and industrial loans. In fact, over half the cumulative dollar volume of loans made to farmers since the origin of the agency in the midthirties has been made since 1975. Two features largely account for this concentration of loans in recent years: inflation and the expansion of the emergency loan categories.

In the last decade alone, total loans per year in the farmer programs increased more than tenfold. In constant dollars this represents about a fourfold increase. Several other measures also show that its relative support to the farm sector increased.

Of the total net additional funds supplied annually by all lenders to the farm sector, FmHA provided about 4 percent in the first half of the decade, but nearly 15 percent in the second half. Of the total outstanding debt of the farm sector, FmHA's share had ranged between 4 to 6 percent in all years until 1979 and 1980, when it rose to 7 and 9 percent, respectively. Virtually all the increased share of outstanding farm debt occurred in the nonreal estate component, which includes emergency disaster loans and a portion of the economic emergency loans.

Further evidence of the growing relative importance of FmHA in the farm sector is the ratio of the number of farmers obtaining FmHA loans to the number of U.S. farms. This ratio increased from about 2-3 percent in most years in 1947-72 to nearly 7 percent in 1973. Although the proportion of farms obtaining FmHA credit subsequently declined, FmHA's relative importance was greater in most years of the late seventies than during its earlier history (fig. 3).

Providing FmHA credit to a larger percentage of all farmers is related to the expansion of disaster lending and to the inception of the emergency livestock and economic emergency programs. In the early seventies, about three-fourths of the loans to farmers were through the ownership and operating loan programs. Over one-fifth were in the emergency category (natural disaster), and the remaining 5 percent were in recreation, grazing, soil and water, and other smaller programs. By the end of the decade, less than one-fourth of the total loans to farmers were made through the operating and ownership programs, and over 70 percent were made through emergency credit programs (natural disaster and economic emergency). By the end of the decade, the emergency livestock loan program had been largely phased out (fig. 4).

During the agency's first 15 years of operation, it appears that in years of relatively high real net farm income, FmHA activity—as measured by the percentage of all farmers receiving FmHA loans—declined (for example, the early fifties). And, in years of relatively low real net farm income, FmHA activity increased (for example, in the midfifties). Such a relationship of FmHA activity with real net farm income would be expected of a lender who, because of the credit elsewhere test, supplements rather than competes with commercial lenders. However, after the early seventies, any such association is difficult to discern (fig. 3).

This change may illustrate that a significant portion of FmHA's farm lending activity competes more with commercial lenders than formerly. In 1978, a limited-resource category of farm ownership and operating borrowers was established. The new program provides a lower interest rate to farmers who, because of lack of equipment, capital, land, or adequate financing, need a lower interest rate for a reasonable chance of success. It recognizes that FmHA serves two groups of farm borrowers: those whose income and cash flow permit financing at near market rates and who therefore are more nearly comparable to other borrowers, and those whose income and cash flow would permit financing only at lower rates of interest. The existence of these two groups of borrowers suggests that FmHA is less a supplementary lender than in earlier years when limited-resource type borrowers were its dominant clientele.

Previous studies by Herr *(2, 3, 4)* in the late sixties of the characteristics of borrowers who obtain operating and ownership loans indicated that these programs provided credit to a group of farmers who were not widely served by other lenders. Thus, Herr concluded that FmHA was largely serving as a supplementary credit source to the farm sector rather than competing with other lenders.

In the late seventies, the characteristics of borrowers who obtained operating and ownership loans were re-examined *(6)*. The more recent study, which provides a current indicator of the characteristics o those served, indicates little change in FmHA clientele.

Farmers receiving Farm Ownership (FO) loans continue to have significantly smaller businesses than the average U.S. farmer. Total assets of new FO borrowers averaged $102,000 in 1977, only 42 percent of the national average of $242,000 (*1*, p. 3).

his was comparable in size to new FO borrowers
the sixties, whose assets of $49,000 totaled 43
ercent of the national average. The average farm
ze of new FO borrowers, as measured by assets,
creased, but at about the same rate of increase as
r all U.S. farms *(6)*.

he relative equity level of new FO borrowers also
hanged little between the sixties and seventies.
he average borrower in the sixties had a net
orth of $15,000, which represented a 53-percent
quity position (net worth/total assets). By the late
eventies, although the average net worth of bor-
owers had increased to $57,000, it represented a
oughly comparable 57-percent equity position.

mHA continues to serve younger borrowers
hrough the FO program. The age distribution of
he average U.S. farm population changed little be-
ween the sixties and seventies; however, the pro-
ortion of FmHA FO borrowers under 35 years of
ge increased significantly (table 1).

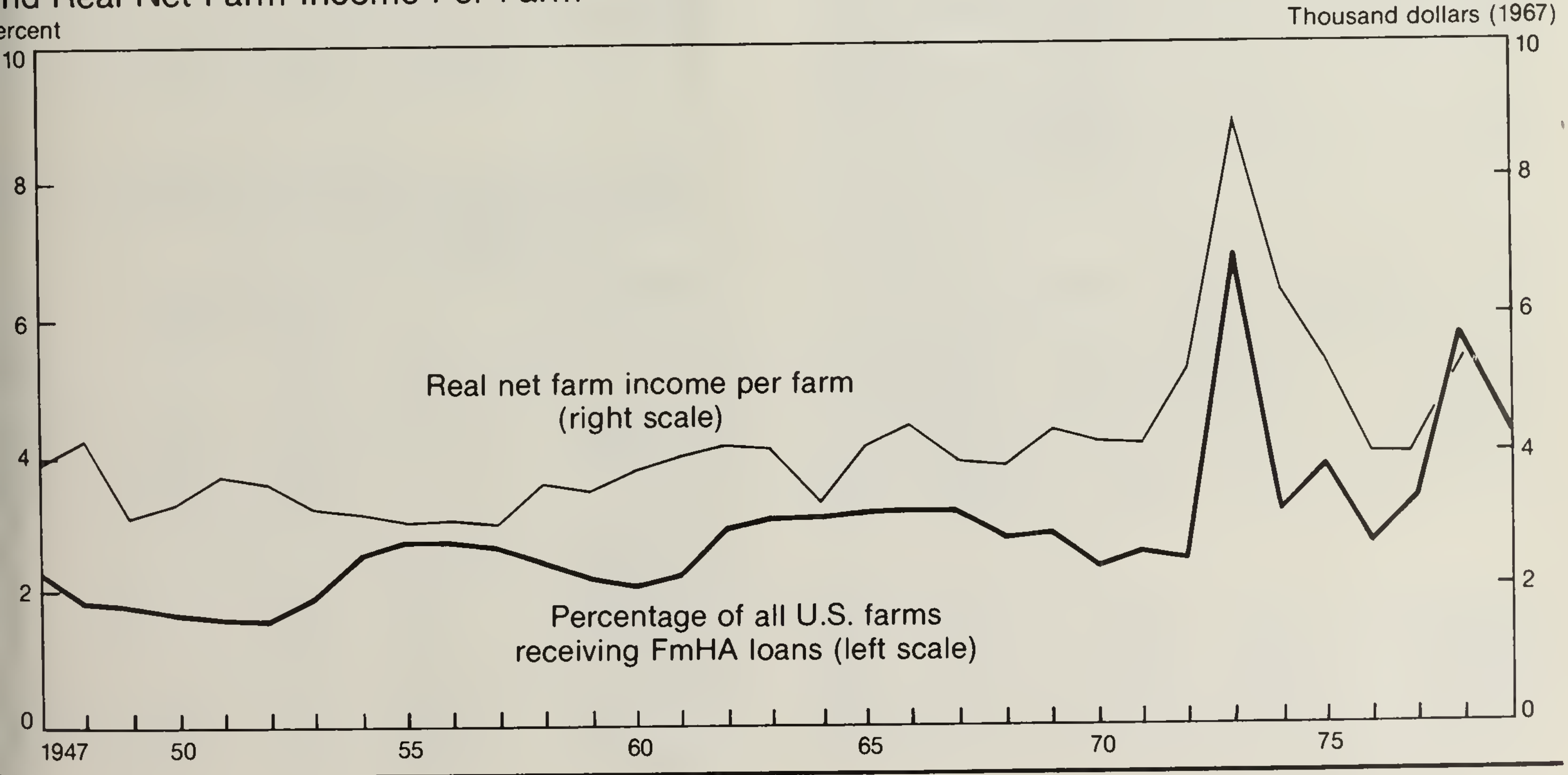
enants and part owners continue to represent a
igher proportion of FO borrowers than they represent in the total U.S. farm population. The proportion that are part owners rather than full owners or tenants increased over the decade (table 2).

Farmers receiving Operating Loans (OL's) from FmHA continue to be smaller than average. Farmers receiving OL's in 1966 had total assets averaging $21,000. By 1977 these had increased to $80,000. As indicated, the average farm size during the 1966-77 period increased from $67,000 to $242,000 as measured by total assets. Expressing average OL borrowers' assets as a percentage of the national average per farm assets shows that the relative size of the OL borrower farm changed little during the decade, rising from 31 to 33 percent.

In 1977, the average equity of OL borrowers was $37,000, compared with $10,000 in 1966. The ratio of equity to assets in 1966 and in 1977 was 48 and 46 percent, respectively, indicating essentially no change during the decade.

The OL program continues to serve even younger borrowers than the FO program (table 3). As with the FO program, the clientele served during the

igure 3
ercentage of FmHA Farm Loan Activity
nd Real Net Farm Income Per Farm



seventies appear younger than those receiving loans during the sixties.

Operating loans are also made increasingly to tenants and those entering farming rather than to full owners (table 4). Tenants continue to make up a much higher proportion of the OL loan portfolio than for the overall economy. Operating loans to full owners have declined.

Thus, the clientele served by FmHA's FO and OL programs have changed relatively little during the last decade. These programs generally serve younger families with smaller farms and relatively modest equity compared with the average U.S. farmers. These FO and OL borrowers are also more likely to be tenants or part owners than is the general farm population. These data from the 1977 study of FmHA borrower characteristics show that FmHA serves farmers who, on the average, have weaker credit ratings than does the average U.S. farmer. The 1966 conclusion that the FO and OL

Table 1—Percentage distribution of farm operators, by age

Operator age	FmHA farm ownership borrowers		All U.S. farmers	
	1966	1977	1964	1974
	Percent			
Under 35 years	33	49	11	13
35-54 years	56	39	49 (est.)	43
55 years and over	11	12	40	44

Source: *Census of Agriculture,* 1964 and 1974.

Table 2—Percentage distribution of farm operators, by tenure

Tenure class	FmHA farm ownership borrowers		All U.S. farmers	
	1966	1977	1964	1974
	Percent			
Full owner	35	25	58	62
Part owner	33	43	25	27
Tenant	26	25	17	11
Nonfarmer	6	6	—	—

— = Not applicable.

Table 3—Percentage distribution of farm operating loan borrowers, by age

Operator age	1966	1977
	Percent	
Under 35 years	31	58
35-54 years	50	30
55 years and over	19	12

Table 4—Percentage distribution of operating loan borrowers, by tenure

Tenure class	1966	1977
	Percent	
Full owner	26	18
Part owner	26	25
Tenant	38	40
Not farming	10	17

Table 5—Selected characteristics of the average farm ownership, operating, and emergency loan borrowers, 1977

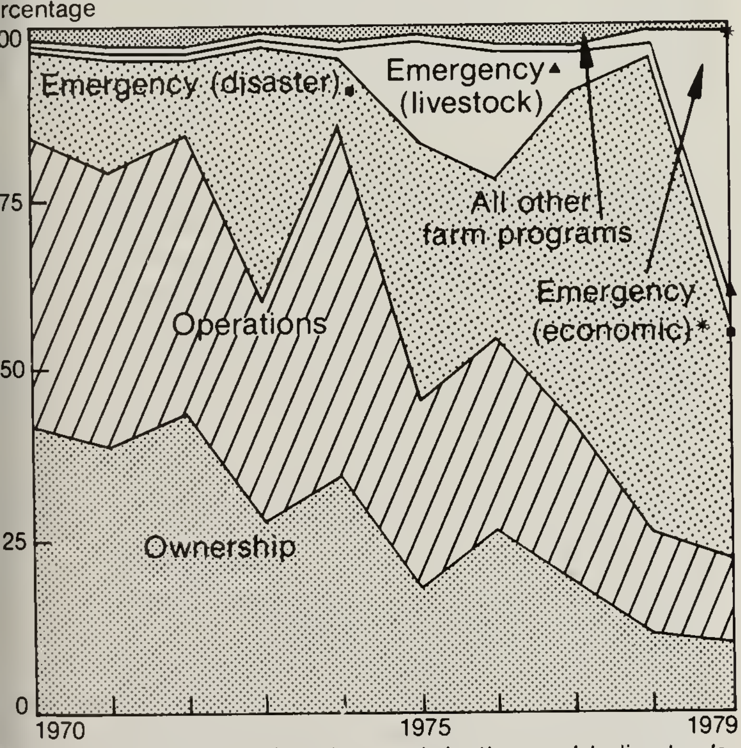
Characteristics	Unit	Loan program		
		Ownership	Operating	Emergency
Total assets	Dollars	102,000	80,000	202,000
Total debts	do.	45,000	43,000	97,000
Net worth	do.	57,000	37,000	105,000
Total acres operated	Acres	275	278	536
Total acres owned	do.	137	164	250
Net family income	Dollars	8,000	10,000	13,000
Under age 35	Percent	49	57	36

an programs serve largely as a supplementary edit source to the farm sector appears to describe eir current programs as well.

ne rapid expansion of emergency loan programs lative to other farm programs is the major factor at is changing the characteristics of the average rm borrower served by FmHA. The Emergency oan Program serves a distinctly different group of rmers than do the FO and OL programs (table 5). n the average, emergency loan farms are nearly vice as large, as measured by acres operated. otal assets owned were 50 to 100 percent larger. nergency loan borrowers have considerably more llars of equity than do borrowers in either of the vo loan programs, but they are leveraged about e same. Net family income is higher, implying eater ability to meet payments on debts at gular interest rates. Moreover, FmHA is authozed to provide emergency credit to those who can otain credit elsewhere, although at higher interest tes.

lthough the emergency loan borrowers (table 5) otained Disaster Emergency Loans (EM), the Economic Emergency Loan Program (EE) has similar eligibility criteria and can be expected to have similar loan portfolio characteristics. As indicated in figure 4, Emergency Loan Programs now represent over 70 percent of total FmHA farm loan volume, up from approximately 15 percent in 1970. The disaster designation criteria and process are being modified in ways that will maintain a high level of farmer eligibility for emergency loan funds. Thus, emergency loan borrowers are becoming the primary FmHA farm clientele.

gure 4
ercentage Distribution of Total Annual ollars Loaned in Farm Programs



ther includes grazing, soil and water, irrigation, and Indian lands.

Limited data are available for comparing FmHA borrower profiles with the characteristics of farmers who obtain funding from commercial lenders. A comparison of FO borrowers (table 5) with Federal Land Bank (FLB) borrowers *(7)* shows that the two agencies serve decidedly different clientele. In 1977, the average FLB borrower owned over $564,000 in assets and owed about $195,000. Similar data for the FmHA farm ownership program are $102,000 and $45,000, respectively. Slightly less than 25 percent of FLB borrowers are 35 years of age or under, compared with 49 percent for FmHA. The average farm and nonfarm earnings of FmHA farm ownership borrowers ($2,900 and $5,300, respectively) were much below those of FLB borrowers, who had farm and nonfarm net earnings of $33,000 and $18,000, respectively.

Emergency loan borrowers are much more like FLB borrowers than are FO borrowers, but there are still considerable differences. The average emergency loan borrower had only $202,000 in assets, a farm income of $19,000 and a nonfarm income of $4,000; 36 percent were under 35 years of age. Since these figures constitute an average, it is clear that the emergency loan borrowers consist of farmers having characteristics similar to both FO and FLB borrowers.

One distinction between FmHA and FLB clientele is indicated by the characteristics of those FLB borrowers when an FmHA subordination or joint closing with FmHA occurs. These borrowers have more than twice the assets, debts, and net worth of FO borrowers; they also show larger amounts of these balance sheet items than do average emergency loan borrowers.

The studies in the sixties and the seventies of the characteristics of borrowers obtaining FO and OL loans indicated that FmHA programs have served approximately the same clientele of farmers over time. However, the growing importance of emergency lending has expanded FmHA's activity to a different group of borrowers. A comparison of selected characteristics of EM borrowers with those obtaining OL and FO loans shows that the financial position of EM borrowers is substantially stronger. FmHA has moved toward a more competitive posture as its emergency loan programs have grown in importance.

Economic conditions were vastly different in the late seventies than previously. Credit use by farmers was greater, interest rates soared in response to double-digit inflation, land values increased at record rates, credit availability shifted between shortage and plenty, and the entire price and income picture showed more variability. In this environment, the Emergency Livestock and Economic Emergency Loan Programs emerged, and in anticipation of large credit use, FmHA provided credit through loan guarantees. Thus, FmHA credit programs helped the farm sector through a period of substantial economic change.

Prospect for the Eighties

The baseline scenario indicates continued increases in farm debt, especially that secured by real estate.[2] However, aggregate projections do not show total debts relative to assets or net farm income moving beyond historical ranges. In fact, funding is projected to decline in importance relative to internally generated funds from farm and nonfarm sources.

The baseline projections show the rate of inflation, as measured by the consumer price index, declining year by year from double-digit rates in the early eighties to a 5-6 percent rate in the last half of the decade. If realized, most interest rates on Government instruments and the prime rate are projected in the 8-10 percent range in the latter part of the decade. Although net farm income may not be as favorable in the early part of the decade as many would like, projections show gains in the late eighties. These projections help us determine whether new financial pressures will be placed on the farm sector or whether a specific group within the sector may be affected adversely.

Financial and Structural Considerations

FmHA credit programs have increased the availability of loan funds to the farm sector. The credit-elsewhere test is intended to avoid substitution of Government-subsidized loan funds for commercial credit. Subsidies occur when administrative expenses are not recovered through interest rates, and in some programs borrowers receive loans at interest rates which are below comparable market rates. The subsidy implies that there is an additional amount of financing which would not have been available to the farm sector in the absence of FmHA.

If this Government farm credit policy had not been pursued, fewer persons would have entered the farm sector, and farms might have been larger and fewer. What is not known is whether these FmHA programs have significantly affected the number of farmers, the efficiency of the farm sector, and income levels within the sector. However, the long history of these programs makes it likely they will continue, although their size and scope will change as sector needs change.

Emergency farm lending programs, which comprised more than half of all farm lending by FmHA in the late seventies, have also affected the structure of the farm sector. They may encourage even greater use of credit and higher leveraged positions. Unfavorable events may not impose such severe hardships because emergency credit is available. Emergency lending programs may, therefore, encourage growth and reduce exit. To the extent that they are the dominant programs, they will encourage firm growth relative to sector entry and will encourage farming in higher risk enterprises and locations.

The baseline scenario described by Hughes and summarized here does not seem to suggest undue financial hardship on farmers or on commercial lenders providing credit to the sector. Farm prices and income will be subject to variability associated with export markets. Although credit market conditions can be expected to change rapidly, one adverse feature of earlier monetary cycles which appears to be disappearing is the scarcity of credit.

Legislation and changed procedures have weakened the effect of State usury laws, have increased the opportunities to attract funds (money market certificates, NOW accounts, and others), and have tended to integrate rural banks more fully into the monetary and credit markets. Although the price o credit may vary, credit tends to be available. We expect that interest rate movements will occasiona ly cause hardships on some farmers just as it will

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[2] See the article by Hughes in this issue.

use difficulties for some consumers and busi-
esses. Although adverse production and economic
nditions will affect the financially aggressive
ore highly leveraged) farmers more than others,
e do not believe their vulnerability will require
y special Government response any more than
at caused by the periodic high price of any input.

ring the mid- and late seventies, some substitu-
n of Government credit programs for Govern-
ent price- and income-support activities may have
curred. Combining these goals was partly respon-
ble for the growth in FmHA activity. Alleviating
st-price squeezes with credit programs treats the
mptom rather than the disease. If these aspects
Government farm programs can be separated,
e projected baseline scenario would show a
cline in FmHA loan activity from its relatively
gh levels of the late seventies. Alternatively, a
ntinued high inflation scenario would boost farm
ctor debt to more than 25 percent of sector
sets. With sector debt in 1990 estimated at about
times its level in 1979, Hughes projects that any
eaknesses in the financial institutions serving the
rm sector would be magnified and would require
creased activity by FmHA.

r all the alternative economic scenarios presented
Hughes, the continued increase in land values is
critical factor for both farmers and society as a
hole. Capital gains from land appreciation provide
centives for farmers as well as nonfarmers and
siness firms to invest in land. This in turn affects
nure, erodes farmer ownership, reduces the op-
rtunity for single-proprietorship entry, and alters
e size and character of land-ownership.

lthough it is beyond our scope to identify a desir-
le structure, we expect that farm credit programs
the eighties will be used to promote entry, farm
nership, and similar objectives. This may necessi-
te redesigning the scope of present FO and OL
ograms. For example, FmHA is in a position to
plore innovative financing arrangements which
ilize the increase in the value of farmland. The
gency could obtain a portion of the equity in-
ease, experiment with graduated loan payment
ans, or try other loan or lease arrangements.

any forces are encouraging larger-size units,
paration of ownership from farm operation, and
vestment in farmland by nonfarmers. Moreover,
rt-time farming is expanding and thereby altering
e structure of the sector further. Although
mHA-type credit programs can affect the structure of the farm sector, we believe the trends outlined are caused by important underlying forces—mechanization, economies of size, and inflation—and will probably be affected only marginally by credit programs, unless the scope of these programs expands beyond their historical one.

We are not arguing that the scope of the FO or OL programs should be altered. We prefer to argue that since we cannot foresee the longrun effects of FmHA credit programs on the structure of the farm sector, we believe it is important to maintain a variety of options for entry, a variety of methods to help people remain in farming, and a variety of ways to encourage growth of farm firms. Programs, such as FO and OL, preserve some options for individuals disadvantaged by limited resources. FmHA programs need to be adjusted and updated more frequently so that the amount and the terms of credit available to any borrower is sufficient for an efficient, viable unit.

Emergency Loan Programs

FmHA provides emergency credit in designated disaster areas to farmers unable to get credit elsewhere. Loan terms and interest rates are favorable compared with those set by market conditions. The volume of this credit varies substantially from year to year. In real terms (1967 = 100), the total annual volume fluctuated between $50 and $450 million from 1960 to 1976 (*5*, p. 3). In 1977, the volume exceeded the previous high (1975) by nearly 50 percent, and in 1978, it more than doubled the 1977 volume (fig. 5).

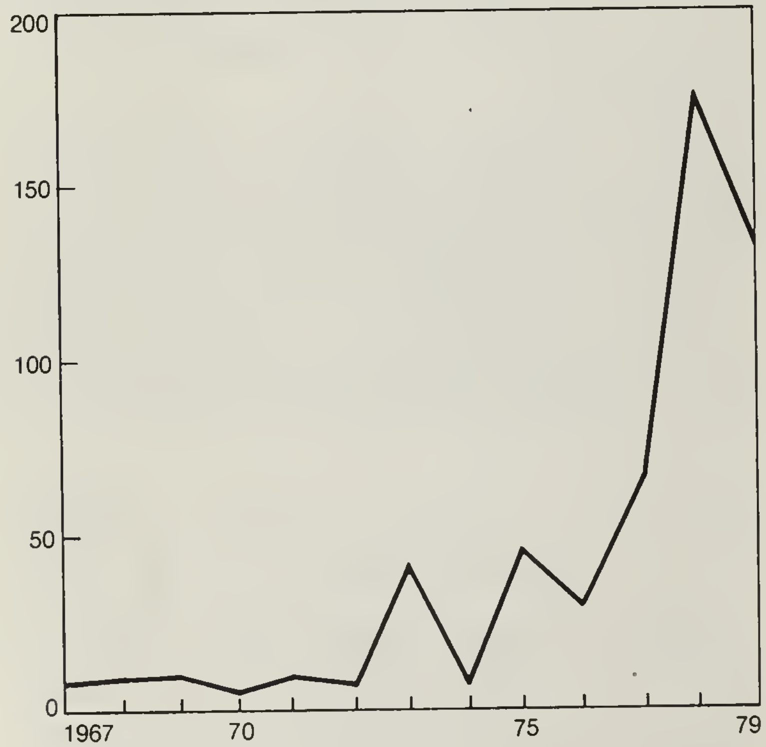
Emergency disaster lending sharply expanded in 1972, following Hurricane Agnes, when the Congress liberalized loan terms and decreed nonpayment of the first $5,000 to cover actual losses. As the costs mounted rapidly, this part of emergency lending was rescinded and was returned to a full repayment basis. Although volume declined to more modest levels in 1974, it expanded in the late seventies and reached unprecedented levels in 1978.

The number of counties receiving disaster designations in 1978 was double that for any previous year, and the severity of the disaster was substantial as measured by dollar loan volume per county. Ladue indicates *(5)* that the volume of disaster lending is also influenced by the interest subsidy provided by low-interest, emergency loan programs. For example, he estimates that in recent years a 10-percent reduction in the interest rate would expand the volume of emergency credit demanded by 8 percent. Apparently, lower interest rates motivate a higher proportion of the eligible farm population to utilize more credit. Additional factors affecting the annual volume of emergency loans are farm incomes, the existence of forgiveness provisions, the administrative climate, and fund availability from other lenders.[3]

Emergency disaster loan volume is, by its very nature, unpredictable. However, a number of variables under the control of policymakers can influence the size of the program. We have noted that the number of counties declared as having experienced a disaster has increased. In recent years, the responsibility for designating a county as a disaster area has shifted from Washington to the FmHA State Directors. Although this authority may permit a more timely lending response, it also provides an incentive for State administrators to declare a county a disaster area. Loan funds originate at the Federal Government level and the subsidy cost is borne by the Federal Government, but the benefits accrue to the farmers within the State. It does not seem surprising that this arrangement leads to a more liberal and varied interpretation of disaster.

Figure 5
FmHA Emergency Disaster Loan Obligations

Billion dollars (1967)



Includes initial and subsequent loans.

Economic emergency lending has provided a different dimension to FmHA's lending. Eligibility for this program required national or areawide economic stress, such as a general tightening of agricultural credit or an unfavorable relationship between production costs and prices received for agricultural commodities. The loan authority establishing this program permitted loans to enterprises which are larger than family farms and thereby provided assistance to a category of farmers not previously served.

If Government funds are not to be substituted for those provided by commercial sources, very careful analysis must be made to determine whether borrowers are in difficulty because of poor management decisions or economic stress. Moreover, some "economic stress" on the farm sector is caused by deliberate Government policy to raise the general level of interest rates or energy costs. Thus, the farm sector must adapt to those broader policy goals just as other sectors must also adjust. It is at such times that considerations of resource allocatio and efficiency are most important. Careful consideration should be given to programs which circumvent or minimize the impact of broader economic goals. Any industry is subject to some economic risks and uncertainties, which in turn cause economic stress. Some stress should, therefore, be considered normal. Strategies to cope with these risks and uncertainties should be part of the firm's management decisionmaking process—for example, cro insurance, hedging, diversification, and reserves—and they need not call forth a response in the form of more Government credit.

The Crop Insurance Program, which will begin wit the 1981 crop year, is the most recent program tha will affect the volume of emergency lending in the eighties. Its recent expansion to increase geographic coverage has the potential for providing more funds to farmers experiencing a disaster and will thereby influence the volume of emergency lending.

Emergency lending intended to reduce the effects of production variability will likely continue to be a part of FmHA activities. Although annual volume o this type of credit is largely unpredictable, some important variables can be altered by policymakers.

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[3] Lower income apparently also motivates a higher proportion of the eligible farm population to participate.

example, it is important to determine what are ptable farming risks. An array of Government grams have dealt with economic and production s—emergency lending, Agricultural Stabiliza- and Conservation Service (ASCS) disaster pay- ts, insurance, price supports, and others. In the ence of determining acceptable risks, *ad hoc* rgency programs may be developed or existing that are not fully justified may be expanded.

not clear whether emergency credit programs be needed in the eighties on the same scale as ng the mid- and late seventies. After the initial k of substantial income, interest rate, and eco- ic variability was recognized, both farmers and mercial lenders adopted procedures that en- d them to cope better with the changing eco- ic environment. For example, improved finan- information and documentation systems are cur- ly used and interinstitutional arrangements and able interest rates tend to maintain fund avail- ty, although the price of credit has become e variable. Furthermore, farmers and their ers are becoming more adept at employing tegies (marketing, price, and insurance) that ad- s problems of income variability.

milar economic changes are projected as part of "economic environment" of the eighties, an ap- riate response might be to help the major rs (farmers and their lenders) adapt to this new ronment rather than to create a permanent ernment credit program which supplants and kens the private sector. Further expansion of IA farmer programs or conversion of "emer- cy programs" into permanent programs can fur- distort allocation of credit within the farm sec- and between the farm sector and other sectors e economy.

HA's Mission in the Eighties

history of FmHA suggests that each time there a perceived capital and credit need in rural s, a program was designed and attached to the ncy. Although this placement may have been cal, it gave the agency a smorgasbord image, h in turn added to its workload and lessened bility to deliver the many loan and grant pro- ns effectively. The Congress and FmHA should gnize that not all credit needs can be met and some needs may be effectively met through the ate sector. Funds allocated for research, plan- , and evaluation within the agency can be used to identify and design programs compatable with stated goals.

FmHA's role has largely been to provide for the following services: public services (for example, water and waste disposal); assistance to those disadvantaged rather than through more expensive alternatives (for example, farm ownership and economic opportunity loans); credit to firms with risks that commercial lenders are not willing to bear but that are potentially viable (for example, emergency loans). Although many rural people and lenders subscribe to Government activities encompassing all these roles, the variety of activities raises important questions, ranging from organization issues to philosophical ones. For example: (1) How do FmHA programs affect the efficiency of the economy and the farm sector? (2) To what extent can inequities in the farm sector be ameliorated by credit programs? (3) Can rural credit programs be most effectively delivered to rural areas by a single agency, such as FmHA, or by a more diverse group of agencies?

As already noted, FmHA activity provides more credit to the farm sector than it could otherwise obtain. Expansion of the aggregate inflow of funds reduces the marginal productivity of capital in the farm sector. This situation may result in a misallocation of capital among sectors because some of these units of capital might earn more in other sectors. However, Government credit programs, policies, and regulations affect the flow of capital and credit to other sectors of the economy as well. Thus, it is difficult to judge the net effect of all these programs on resource allocation in the economy.

Similar questions can be raised about specific FmHA programs. Ownership loans encourage greater farm ownership and contribute to higher real estate values. Emergency loans may help maintain a specific type of farming in more risky areas. However, it is extremely difficult to determine whether this represents a misallocation of resources.

A related question is whether credit markets discriminate against specific people, types of farms, or forms of business organizations. Discrimination and related misallocation of resources arising from lack of information, imperfect knowledge, and prejudice may partially be corrected by providing appropriate information. If discrimination and inefficient resource use continue, a stronger case may be made for Government intervention. Evidence of persistent inefficiencies would provide a basic rationale for the agency's mission.

Another feature of FmHA's mission is to aid those disadvantaged because of resource endowment, natural disaster, and hardships beyond their control. Although credit programs of this type may contribute to resource misallocation, they are usually justified on the basis of social justice and equity.

The degree to which the programs of FmHA are focused towards welfare-oriented social objectives, such as a minimum level of living and continued employment, has varied considerably over the life of the agency. However, programs such as the Economic Opportunity Program of the sixties and the Limited Resource Program of the late seventies were partly aimed at people who seemed not to have a high probability of becoming independent if privately financed. Similarly, the subsidy aspects of some of the housing programs are designed to increase the effective income level of rural residents. Emergency loan programs frequently include attempts to offset disaster losses with subsidized interest rates and forgiveness provisions.

Some Government credit programs may be partly justified on the ground that, in the absence of credit, the firm or individual would seek other forms of Government aid that would be more costly. In the absence of credit programs, such individuals might also obtain nonfarm employment. Some might displace others who, in turn, would seek aid from a different program.

In designing future FmHA programs, we need to determine: (1) whether these programs are effective in meeting welfare-oriented social objectives, (2) which social objectives individual programs should address, and (3) whether programs with more welfare orientation should be separate from programs designed to provide credit where shortages exist. A clear understanding of the purpose of a specific program—for example, improving resource allocation or accomplishing equity goals—helps determine the size, length, and other parameters. Without such careful scrutiny, programs grow unchecked and missions become blurred.

Defining FmHA's mission will also affect its delivery system. Basically, FmHA is in the business of delivering credit to firms, households, and other entities in rural areas. We believe developing credit expertise can be usefully adapted to a variety of programs. In fact, commercial banks, though often departmentalized, essentially follow this principle. Thus, there are strong reasons for attempting to improve FmHA as a credit agency serving rural areas. To provide the necessary expertise which comes from specialization, planners may find it necessary to create sub-State offices or to combine county offices so that several (perhaps 10-15) loan officers can operate from one main location with branch offices serving outlying areas. This solution simply recognizes that the degree of specialization is limited by the size of the market. It may also per mit more timely response to emergency or special loan programs, as a minimum number of loan officers are available to respond to short-term lendin priorities.

Another alternative would be to dismantle FmHA as an all-purpose agency. Although the final configuration might be different, the idea would be to assign the housing loan function to the Department of Housing and Urban Development, assign busines and industrial loans to the Small Business Adminis tration (SBA) or Economic Development Administration (EDA), and assign emergency lending to the ASCS disaster price support program. What would be left would be a farmer-oriented agency. (We not many other configurations are possible. For example, it has been proposed that transferring all farmer programs to ASCS would free FmHA to co centrate on rural community and economic develop ment.) Proponents of this view believe that the rearrangement would result in a more efficient delivery system. It would concentrate expertise in similar programs and would reduce duplication. Th goal of restructuring would be to achieve greater specialization, as few persons can become proficien in the wide range of programs currently administered by FmHA.

While the delivery system is important, a feature which might be overlooked is that FmHA is both a farm loan agency and a housing and community development agency. Its activities in the nonfarm area are likely to have at least the same effect on small towns and the structure of rural areas as its farm programs have on the structure of the farm sector. Water systems, waste disposal systems, housing, and business and industrial loans frequen ly determine the future of rural communities. Therefore, the agency or its separate program areas need to be part of, or least coordinated with the efforts of development and planning agencies t foster consistent and rational development of rura areas.

ancing FmHA's Activities

re are currently two basic ways FmHA farm programs are financed—by insured loans and guaranteed loans. Guaranteed loans are made serviced by commercial lenders. FmHA guaran- s to limit losses to a specified percentage, up to aximum of 90 percent. Insured loans are made serviced by FmHA and are, therefore, some- es referred to as "direct" loans. Funds are ob- ned through the Federal Financing Bank which urn replenishes a revolving loan fund. Shortages made up by the Congress which provides the ncy's annual budget. Assuming continued com- ment of public funds to the rural sector, the ding sources will likely continue.

ention of the credit-elsewhere test helps sepa- e FmHA programs from credit programs pro- ed by commercial lenders and helps reduce the stitution of Government credit for that obtained m commercial sources. Assuming both sources of ding are used, insured loans would probably ry a higher risk, involve more subsidy, and re- re greater supervision than would guaranteed ns.

ese two sources of funds will likely provide for longer run sector needs for Government credit. sured loans can provide for the basic needs of ited-resource farmers, and guaranteed loans for variable needs of the sector that are affected by nomic or other short-term forces. Expansion and traction of the guaranteed loan program would not involve large governmental costs, as FmHA should be able to leverage the volume of guaranteed loans against some budgeted base. The base could either be changed as necessary, or if required, the leverage ratio could be altered. Many bankers believe that an important part of the success of the guaranteed loan program is a viable secondary market. If this market does not develop naturally, it may be necessary to allow FmHA to facilitate this process.

To date, the guaranteed loan program has not been as successful as intended. Use of guaranteed loans in all farmer programs is small relative to the volume of direct loans and has not increased significantly (table 6). Negotiable interest rates may have made these loans more desirable for lenders, but if borrowers find rates on insured loans lower than on guaranteed loans (as is often the case), they will continue to seek the insured loan. Further reducing paperwork and streamlining procedures could make the program still more attractive. Lenders may have little incentive to make such loans because service requirements sometimes exceed those for their regular loans, as third parties are involved and as the loans sometimes count against the overall loan authority even though Government funds are only a portion of all loans.

Additional study is needed on the relatively low use of the guaranteed program and on the characteris-

ble 6—Guaranteed loan volume as a percentage of insured loan volume, by selected FmHA programs, 1974-79[1]

ear	Farm operating	Farm ownership	Emergency (all types)	Economic emergency	Rural housing	Business-industry
			Percent			
974	2.9	0.2	[2]	[3]	0	99.3
975	3.3	.3	7.0	[3]	0	97.0
976	1.8	.2	7.5	[3]	0	97.1
977	.9	.2	1.0	[3]	0.1	88.8
978	.3	.1	[2]	0.3	0	98.6
979	1.8	1.4	.1	4.4	.4	100.0

[1] Emergency livestock, soil and water, and recreation loans omitted. All emergency livestock loans were made on a guaranteed asis; a few soil and water loans have been guaranteed, and guaranteed recreation loans were nearly 10 percent of the volume of sured recreation loans in 1979.

[2] Less than 0.05 percent.

[3] The Economic Emergency Program did not exist prior to 1978.

tics of borrowers obtaining such loans. The program seems desirable for the following reasons: (1) it uses private-sector funds, (2) it may provide enough additional volume to maintain the lender in an area where a marginal loan volume is needed to support a specialized farm lender, (3) it can accomplish "graduation" more easily, and (4) it has the potential for shifting some of the workload to the lender and thereby ease the caseload problem of FmHA personnel.

Conclusions

FmHA has grown tremendously, and its activities have shifted from serving farmers to serving the credit needs of rural areas. Within the farmer program category, the focus has shifted from limited-resource farmers to emergency credit programs.

We believe it is important that Government credit not be used to respond to all kinds of economic stress. Some risk is normal in any industry. We also believe that the extent to which FmHA is designed to help with social problems and to alleviate economic inefficiencies must be specified.

The future economic and social environment in the United States will affect FmHA's mission in the eighties. However, we believe it will not be so harsh as to require a new or expanded FmHA. Even if economic conditions were extreme, we believe attempts should be made to make commercial credit markets work before expanding FmHA. Although FmHA will likely continue to serve groups perceived as disadvantaged, we do not find evidence that a larger group of farmers is excluded from commercial credit sources or is otherwise eligible for FmHA-type programs.

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he Commodity Credit Corporation nd Agricultural Lending

Bruce Hottel*

Abstract

The role of the Commodity Credit Corporation (CCC) in agricultural lending has changed since its beginning in 1933, reflecting changes in Government farm programs and farm economic conditions. The CCC's original purpose of helping to minimize the effects of depressed commodity prices has been deemphasized as the program has shifted to the financing aspects of crop inventories. With a "most likely" healthy farm economy in the eighties, CCC's share of total farm nonreal estate debt is expected to change only slightly from that of the seventies—about 6-8 percent. With an unhealthy farm economy, CCC's share of such debt will be substantially higher.

Keywords: Commodity Credit Corporation, Farm lending, Farm credit

troduction

ie Commodity Credit Corporation's (CCC's) role in
ricultural lending has changed over time as Gov-
nment farm programs and farm economic condi-
ons changed. Farmers have used the CCC as both
residual market and as a speculative and market-
g aid *(2)*.[1] In recent years, Government price-
pport loans (including those made by the CCC)
ve been only part of a more complex set of farm
ograms. The strengthening aspects of other in-
me program provisions have resulted in a
duced need for price support loans. CCC loans
ntinue to be an important element in minimizing
e effect of depressed commodity prices on farm
come; however, program emphasis has shifted to
nancing crop inventories.

conomic conditions of the eighties will have a ma-
r influence on the relative importance of CCC
nding. A healthy farm economy would mean that
CC lending would increase in line with increases
total debt supplied by other agricultural lenders.
his would represent a continuation of the reduced
elative use of CCC loans by farmers as was characteristic of the seventies. A less healthy farm economy would mean a tendency toward a greater proportion of debt funds supplied by the CCC and other Government lenders.

In this article, I discuss how producers and marketing cooperatives have used the CCC to fulfill their financing needs over time as economic farm conditions and Government farm programs have changed. I also speculate on how the present orientation of farm programs, future prospects for the farm economy, and possible changes in farm programs may affect the role of the CCC in farm lending.

General Nature of CCC Loan Programs

Farmers, sugar processors, and approved farm marketing cooperatives can place eligible production in approved storage for specific time periods and receive a nonrecourse loan from the CCC equal to a fixed price per unit (loan rate) multiplied by the quantity of crops in storage.[2] The basic eligibility

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ggestions.

[1] Italicized numbers in parentheses refer to items in the Litera-
re Cited at the end of this article.

[2] Loans are nonrecourse in the sense that, if farm prices are below the loan rate, the commodity pledged as collateral can serve as full payment of principal and interest on the loan; the loans thus assure the farmer a minimum price. If loans are repaid by redemption, the participant must repay the principal, plus interest based on CCC interest rate charges, and storage costs for the length of the loan. If the CCC takes title to the commodity as fulfillment of the loan obligation, the participant pays no interest on the loan, but must pay for storage costs.

requirements for a CCC loan are that producers comply with USDA's allotment or set-aside programs and store their crops in CCC-approved facilities. Participants in the CCC loan program have two basic choices.

The first choice includes the regular nonrecourse loan program, which makes loans available during the 10 months following harvest (the loan can sometimes be extended for several additional months). These loans have been available for basic agricultural crops since the midthirties (see box). The participant can sell the commodity prior to or at maturity, thereby redeeming the loan. Thus, the loan program offers farmers or their marketing cooperatives short-term financing for meeting outstanding financial obligations soon after harvest and simultaneously allows the commodities to be held for later sale and possible benefit from any price increases.

Since April 1977, a second choice for nonrecourse loans has been the farmer-owned grain reserve program (FOR) for producers of eligible rice, wheat, corn, sorghum, barley, and oats. However, periodically grain is eligible for immediate entry into the FOR. Under the reserve program, participants have the same minimum price protection as under the regular loan program but enter a longer (3-year) contract, agreeing to hold grain in the reserve until the contract matures or until the national average market price reaches a predetermined release level *(6)*.[3] Upon loan maturity or at a "call" price currently ranging from 145 to 185 percent of the loan rate (depending on the individual commodity), the par-

The CCC and Farm Programs

The CCC was established by Executive Order in 1933 as part of a package of emergency farm programs designed to boost farm income and to foster an efficient and orderly marketing system *(4)*. Affiliated with the Reconstruction Finance Corporation until 1939, the CCC is a USDA agency operating through personnel and facilities of the Agricultural Stabilization and Conservation Service and other USDA agencies. The CCC, as the fiscal agency and instrument of the U.S. Government for agricultural commodity programs, is authorized by charter and by statute to buy, sell, make loans, store, transfer, export, and otherwise engage in agricultural commodity operations *(3, 9, 10)*.

A basic justification of CCC loans under the original charter was that they enable farmers to hold their commodities after harvest until prices rose as a result of production control programs *(4)*. Although a primary objective of the CCC is to minimize the effects of the depressed commodity prices on farm income, the financing of the marketing of several important farm products has been greatly influenced by CCC lending and other price support activities *(5)*.

Current provisions of farm price support and income maintenance programs are largely embodied in the Food and Agriculture Act of 1977. Guarantees of minimum farm prices are required or authorized by law for wheat, corn, peanuts, rice, tobacco, wool, mohair, upland and extra-long-staple cotton, honey, barley, oats, rye, sorghum, milk and its products, flax, soybeans, gum naval stores (rosin), sugar beets, and sugarcane. Loans on tobacco, peanuts, and gum naval stores are made through cooperative producer associations, and on rice, cotton, corn, oats, rye, barley, sorghum, soybeans, wheat, and honey, either directly to farmers or to cooperatives on behalf of their members *(7)*. Farmer cooperatives' eligibility for loan privileges were available for cotton prior to 1943, for rice since 1943, for soybeans and honey since 1961, and for wheat and feed grains since 1977. Marketing cooperatives act on behalf of eligible producers by pooling the commodities and CCC loans are disbursed in the name of the cooperative. Loan funds from the CCC to the cooperative are disbursed within 15 days to participating farmers, after allowances for any marketing expenses incurred. If sales by the cooperative return a profit over the loan advances to farmers, charges, and interest, the proceeds are then prorated to growers participating in the pool *(7)*.

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[3] Reserve grain is "released" when the national average market price reaches 140 and 145 percent of the loan rate for wheat and rice, respectively, and 125 percent for feed grains. At this point, participants can either repay their loans or leave the grain in reserve. However, storage payments stop with the second consecutive monthly "release" notice.

pant is required either to redeem the loan or to
feit the commodity. Storage requirements and
interest rate charged on reserve loans may be
same for grain placed under the regular loan
gram. However, no interest is currently charged
er the first year of the reserve agreement and
ual storage expenses are paid in advance by the
C.

course loans for storage facilities, drying, and
er grain-handling equipment are also available
m the CCC. USDA has used the loan programs
several years to encourage both increased farm
rage and development of improved farm storage
lities, including handling and conditioning equip-
nt. Recourse loans on grain storage and drying
ipment are available to participants for up to 85
cent of the cost of construction. Current loan
its cannot exceed $100,000 per farmer. Loan
ayment allows a maximum of seven equal annual
tallments over a period of 8 years. Interest
rges on these recourse loans vary slightly from
se charged on nonrecourse and reserve program
ns.

storic and Current Role of the CCC

vo basic factors are important in explaining the
anging role of CCC in providing farm credit:

- The role that Government farm policy has played over time in shifting from programs with primary emphasis on price supports alone to those that include both price supports and income supplements.

- The importance that farmers have placed on the use of nonrecourse loans as a source of interim financing and the cost of Government financing relative to other loan sources.

ese factors are discussed below.

an Rates Over Time

e importance of loan rates to farmers has changed
er time, due to the farm programs' changes in
phasis (fig. 1 and table 1). Prior to the early fif-
es, the programs emphasized improving the eco-
mic conditions of farm operators. That was done
establishing commodity price guarantees and
an rates based on fixed-formula techniques tied to
vels of parity between farm and nonfarm prices.
wer, flexible parity price-support levels were
tried in the midfifties and loan rates declined, reflecting a reduced emphasis on price supports and greater emphasis on other programs to improve farm income. Although the loan rates have trended higher since the seventies, due to changes in loan rate procedures to reflect rising production costs, farm program policies continue to emphasize income maintenance.

CCC Lending Compared to Other Sources of Financing

CCC debt outstanding has risen in an extremely cyclical variation since the late forties, but has risen less rapidly than other sources of nonreal estate debt. For instance, outstanding CCC debt to farmers alone trended downward from nearly 60 percent of total nonreal estate farm debt from commercial banks and production credit associations in the midfifties to nearly 10 percent in recent years (fig. 2). CCC debt outstanding for both farmers and farm marketing cooperatives was $6.3 billion on January 1, 1980—up 67 percent from January 1, 1970. In the same time, outstanding debt from other nonreal estate loans increased by 234 percent (table 2). Also, part of the rise in outstanding CCC debt was due to a substantial increase in debt outstanding for grain storage and drying facilities. Thus, an increasingly larger share of nonreal estate capital funds of producers has been provided by loan sources other than the CCC.

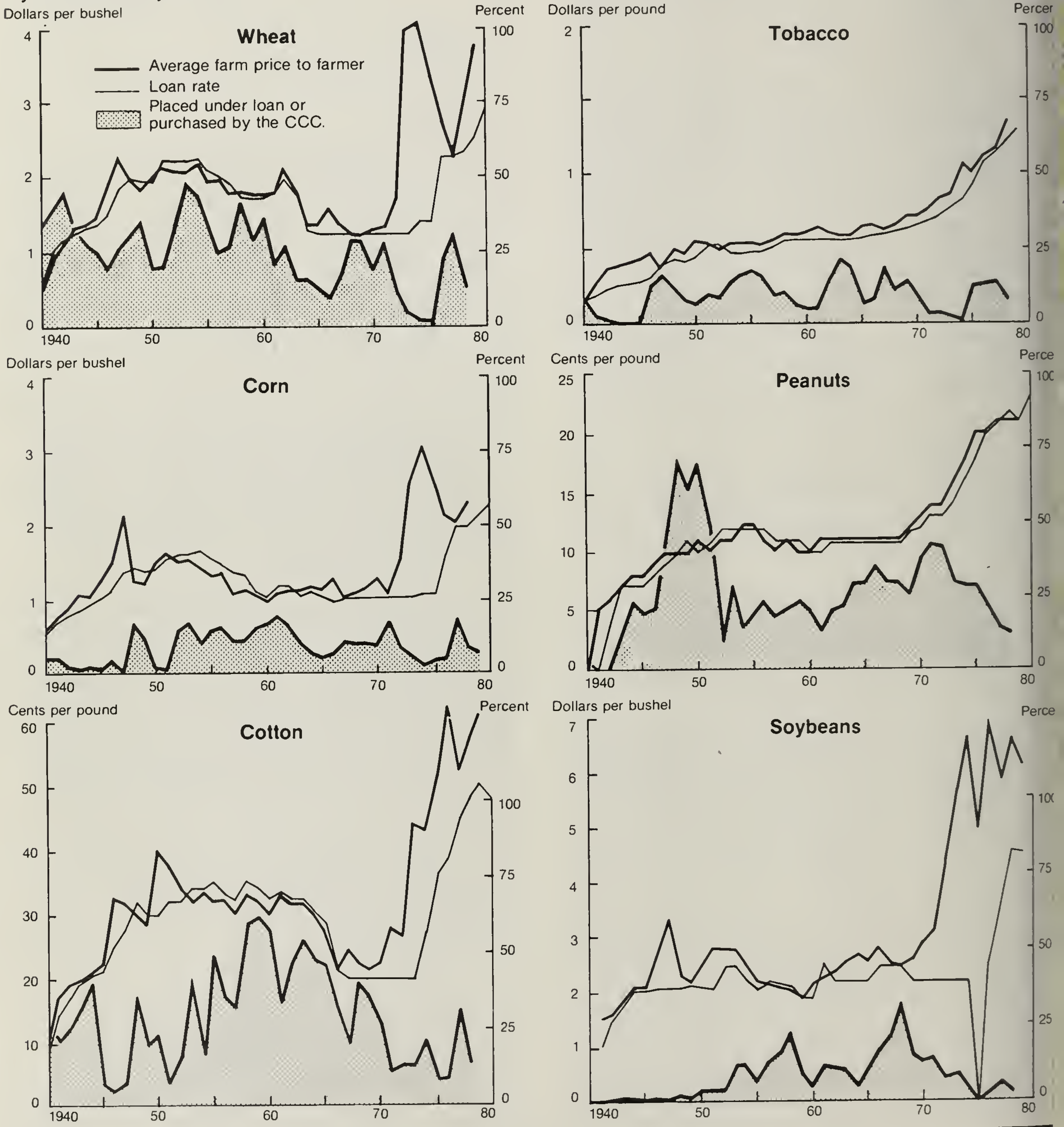
The relative decline in loan funds provided by CCC is explained in part by the earlier discussion in this article of the change in emphasis of farm programs —basically from those that primarily emphasized high price maintenance to those of lower price maintenance and higher direct payment programs. This has tended to lessen farmers' dependence on the CCC loan programs. In addition, commodity prices during the seventies generally increased relative to loan rates, further reducing farmers' dependence on the CCC for minimum price supports. The Government's continuing emphasis on income maintenance programs may also have enhanced the credit capacity of farmers and thus contributed to lenders' willingness to finance higher levels of farm debt.

CCC Participation and Interim Financing

Although farm program changes and changes in farm economic conditions since the fifties have tended to lessen farmers' dependence on CCC loan programs, many farmers continue to use the CCC

Figure 1

Average Prices Received by U.S. Farmers, Loan Rates, and Percentage of Total Crop Production Placed under Loan or Purchased by Commodity Credit Corporation (CCC), By Commodity, 1940-80



ı means of minimum price guarantees. However, relative importance of Government loan pro-ms has tended to shift to providing interim ıncing for crop inventories.

ure 1 shows that CCC loan participation tends to directly related to the difference between CCC n rates and commodity market prices. When rket prices are near or below loan rates, CCC gram loan participation increases. The opposite urs when market prices rise above loan rates. ıs, producers appear to have made substantial of the loan program during periods of declining m prices. However, despite this close relation-p, a study by Miller, Meyers, and Lancaster *(2)* icates that, in addition to commodity price-loan ations, loan activity by farmers is influenced by er variables, such as interest rates and pro-ers' expectations about variability in seasonal p prices (risk).

ble 1—Acreage enrolled in Government programs, making producers eligible for Commodity Credit Corporation (CCC) loans, by commodity, U.S.

ar	Corn	Grain sorghum	Barley	Wheat	Cotton
	Percent of total acreage planted				
62	36.0	45.6	16.6	N.A.	N.A.
63	42.1	47.1	32.8	N.A.	N.A.
64	37.1	43.6	30.1	N.A.	N.A.
65	42.5	42.5	42.5	75.8	N.A.
66	37.0	50.6	36.9	77.5	95.6
67	38.9	58.6	N.P.	79.8	N.A.
68	41.9	50.6	N.P.	82.3	100.0
69	45.1	48.8	34.7	79.3	99.4
70	43.7	50.1	35.2	79.4	99.8
71	74.4	78.9	N.P.	86.8	99.9
72	70.8	67.1	64.3	81.0	98.5
73	77.8	78.6	72.5	83.9	100.0
74	N.P.	N.P.	N.P.	N.P.	N.P.
75	N.P.	N.P.	N.P.	N.P.	N.P.
76	N.P.	N.P.	N.P.	N.P.	N.P.
77	N.P.	69.8	78.8	87.2	N.P.
78	40.5	64.2	57.7	62.5	N.P.

N.P. = no program.
N.A. = not applicable.

Source: Compiled from Agricultural Stabilization and Con-rvation Service program books and agricultural statistics by n Johnson, Program and Policy Analysis Branch, Economics ıd Statistics Service, U.S. Department of Agriculture.

Empirical estimates of producer behavioral models for corn and wheat put under CCC loan during 1977 indicated that a 10-percent reduction in the ratio of CCC corn and wheat loan rates to market prices would reduce the amounts of corn and wheat under loan by approximately 17 percent. A 10-percent increase in the ratio of the CCC interest rate to the interest rate on loans from Production Credit Associations would reduce the amount of corn and wheat under loan by approximately 4 percent.

Although the factors determining loan participation are somewhat complex, one apparent factor is how farmers and managers of farm marketing cooperatives view their need for CCC loan programs versus the cost they incur for borrowed funds to hold grain inventories. Loan participants are becoming more sensitive to interest rates charged on CCC loans and alternative loan sources. This is especially true of marketing cooperatives.

Historically, the interest rate charged by the CCC has been less than that charged by other lenders (fig. 3). The difference between the CCC rate and the rate charged by other lenders was relatively constant over the 1940-72 period, but the difference has narrowed since 1972. Thus, during more recent years, the cost of money for crop inventory loans from CCC has not been much cheaper than the cost of money from alternative loan sources.[4] The increase in the CCC rate is based on the upward trend in the Treasury rate, on which CCC's cost of borrowed funds is determined. Prior to the early sixties, the CCC interest rate paid by farmers was generally not subsidized, but since then it has usually been subsidized. This general movement, especially since the seventies, is more consistent with keeping the CCC interest charges in line with CCC borrowing costs from the Treasury *(8)*.

Marketing cooperatives became more heavily involved in CCC loan participation in the midsixties and have tended to be more sensitive than individual farm operators to money cost differentials in terms of loan participation (fig. 4). When rates of interest from PCA's begin to increase in relation to charges by alternative loan sources, CCC loan activity begins to increase.

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[4] Use of average PCA rates to illustrate alternative cost of nonreal estate loans understates to some extent the general movements in money market rates since PCA interest rates are based on average cost pricing, rather than on marginal cost pricing. However, the lags associated with PCA rates, as compared with movements in rates by larger banks that tend to more closely reflect general market rate movements, do not negate the point of the closer relationship between CCC loan cost and the cost of alternative sources of loan funds during more recent years.

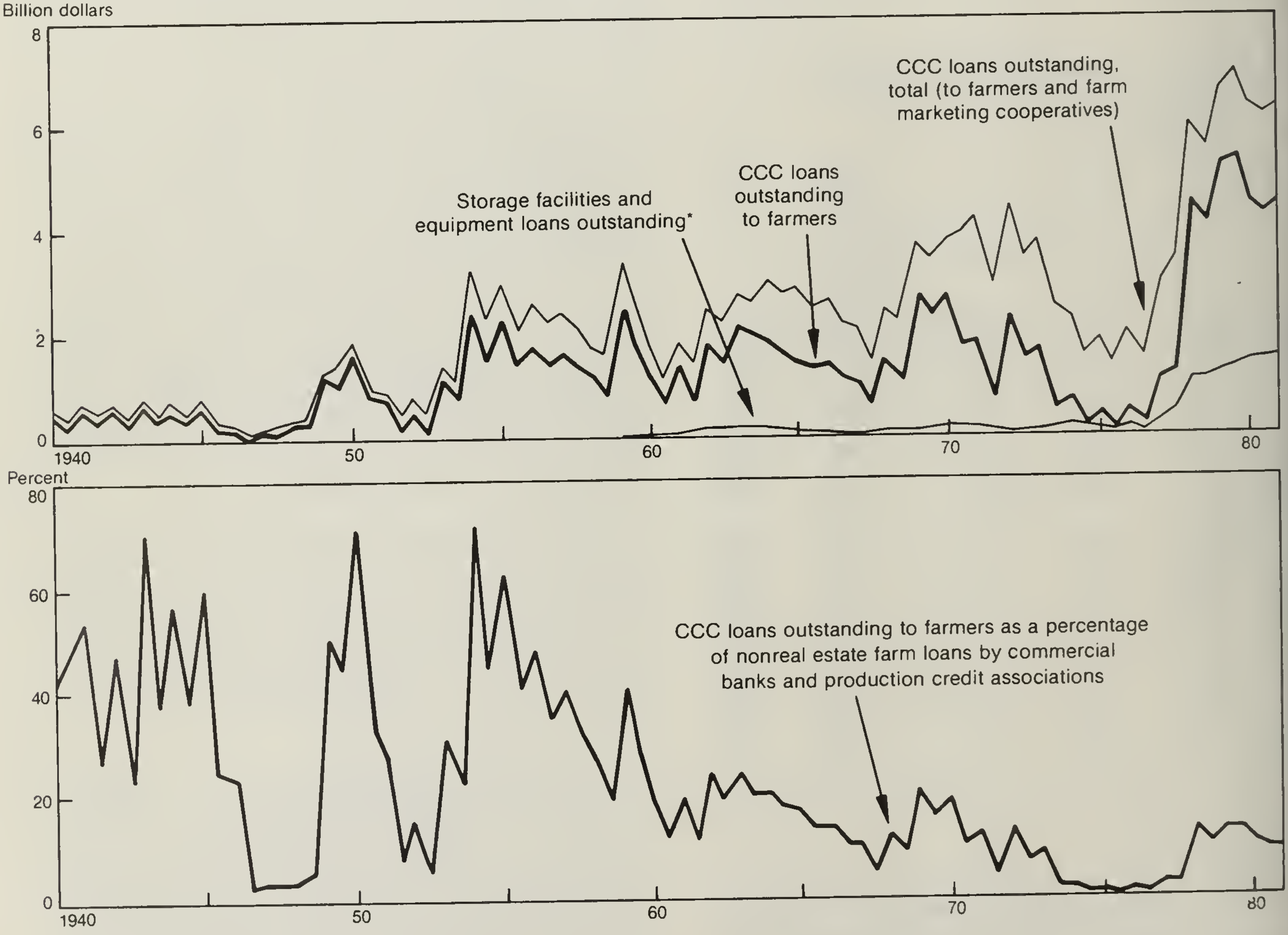
Marketing cooperatives generally operate on a pool basis with partial payments to their producers made at specified periods during the marketing year. The first payment, at time of delivery by the producer, usually runs 50-75 percent of the commodity's value. Cooperatives must have a source of funds to make the initial payment. As the crop is marketed, other partial payments and the loan repayments are made. Cooperatives eligible for CCC nonrecourse loans normally consider the CCC as one source of short-term credit even though the market price may be considerably above the loan rate.

Implications

The fact that the CCC's share of total nonreal estate loan funds utilized by producers has declined may indicate that the CCC is not maintaining its role of funding the growing capital needs of agriculture and should modify its program to make loan funds more available. Nonetheless, the issue is

Figure 2

Commodity Credit Corporation (CCC) Loans Outstanding and the Relation of CCC Loans to Other Nonreal Estate Loans, July 1 and January 1, 1940-81



*As of January 1 only.

e 2—Nonreal estate farm debt outstanding, by lender, January 1, selected years

Lender	1950	1960	1970	1980	1970-80
	Million	*dollars*			*Percent*
enders, excluding Commodity Credit Corporation (CCC)[1]	5,154	11,528	21,168	70,700	234
mercial banks and production credit associations	2,436	6,372	14,833	48,045	224
[2]	1,750	1,740	3,798	6,345	67
wed by farmer cooperatives	29	575	1,122	1,845	65
wed by farmers	1,721	1,165	2,676	4,500	68
loans for storage facilities and equipment[3]	13	38	170	1,391	718

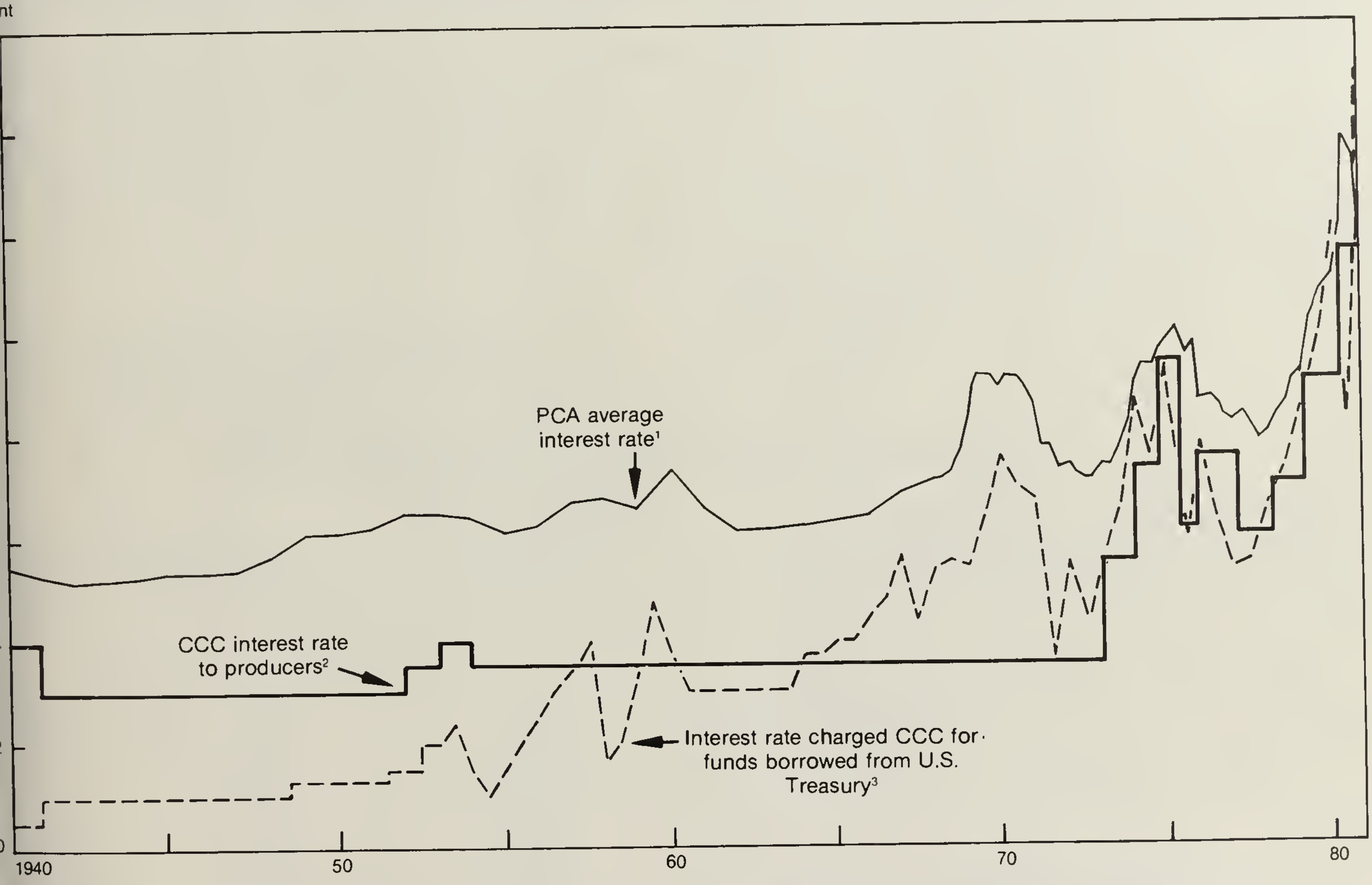
cludes nonreal estate farm debt owed to all commercial banks, production credit associations, Farmers Home Administration, ral intermediate credit banks, individuals, and others.

cludes commodity debt and debt held on commodity storage facilities and equipment by farmers, and farmer cooperatives.

ebt held by the CCC on storage facilities and equipment included in the above estimates.

re 3

erest Rates on CCC Loans, Production Credit Association (PCA) Loans, and on Funds rowed by CCC from the U.S. Treasury, 1940-81



[1] Annual average rates from 1940 through 1961 with average rates at beginning and midyear thereafter. Stock purchases and loan fees required of borrowers are not taken into account in rates shown. Source: *Agricultural Finance Databook*, Board of Governors of the Federal Reserve System.

[2] Any new loans on 1979 crops after April 15, 1980, were 13 percent as compared to 9 percent on 1979 crops prior to this date. Interest rates on loans for 1980 crops were 11.5 percent as of late 1980.

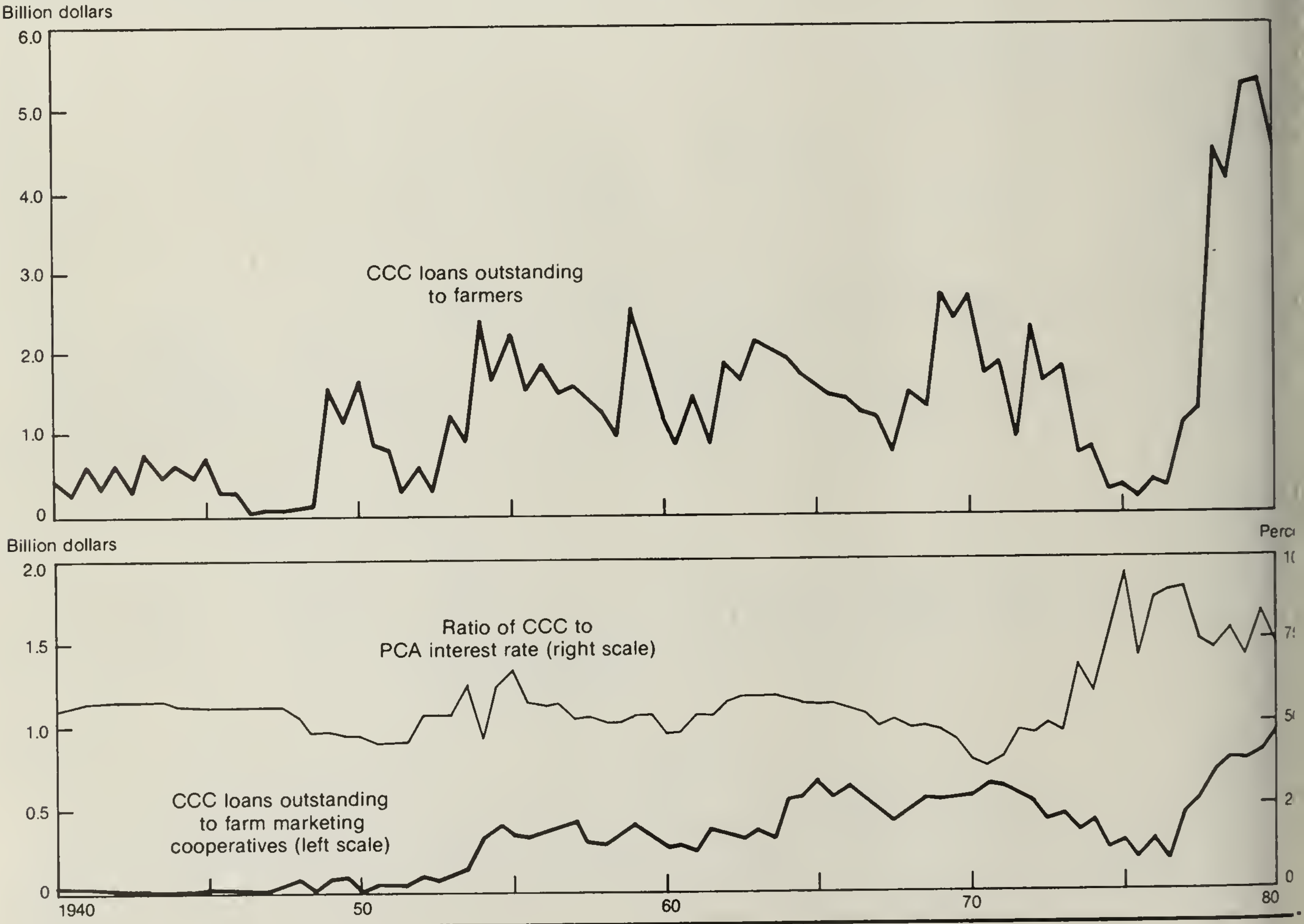
[3] Data provided by CCC. Rates are as of January 1 and July 1.

whether the CCC can preserve its primary role of assuring price protection for major crop commodities and simultaneously strengthen its lending role in an increasingly debt-intensive agricultural industry where crop inventory management has tended to increase in importance. If farmers were permitted to borrow in advance (preharvest) from CCC on their potential crop, CCC would be in direct competition with other lenders who have supplied these funds in the past. Producers would not necessarily benefit by substituting Government loan sources unless they could reduce their cost of debt funds through lower CCC interest rates. Farmers under this program of early advances would be assured of operating funds for meeting preharvest input expenses, but from the past experience of major agricultural lenders, debt repayment and cash flow diff culties appear to be of more concern than fund availability *(1)*.

In terms of increasing crop inventory management options, extension of loan maturities on regular CCC loans would allow producers greater opportunities for holding commodities for possible price increases over a longer time period. The current reserve program allows this flexibility to some extent, but locks in producers into a relatively rigid system of release and call prices. On occasion, the

Figure 4

Commodity Credit Corporation (CCC) Loans Outstanding to Farmers and to Farm Marketing Cooperatives and the Ratio of CCC to Production Credit Association (PCA) Interest Rates, July 1 and January 1, 1940-80



C has extended loan maturities on regular loans, this is usually in situations where commodity ces are depressed, and no consistent policy for n extension exists. Increased debt loans by indi-ual producers due to more than 1 year's inven-y would not necessarily create additional repay-nt problems, unless CCC loan proceeds were less n enough to cover the financial obligations.

other issue is providing CCC loan borrowing vileges to those who do not comply with program visions applicable to the commodity produced. king nonparticipants eligible for CCC loans uld not change the current pattern of eligible ducers using CCC loan activities primarily for ce protection rather than for source of credit. wever, CCC loan volumes during periods of de-ssed prices would increase with the additional ducers eligible. However, if this policy was owed, the incentives of producers to participate supply management programs, would be lessened ring periods of excessive commodity supplies and mpen farm program efforts in strengthening farm ces. Farm marketing cooperatives would be able utilize more CCC loans if nonparticipants were tended these privileges. If the majority of cooper-ve members were in a nonparticipating category, their capital base would be extended, which the cooperative would then use as a source of additional capital funds.

ble 3—Alternative projections of total farm nonreal estate loans outstanding, U.S.

Year eginning nuary 1	Total farm nonreal estate loan funds outstanding: Baseline (most likely)	Total farm nonreal estate loan funds outstanding: Stagflation (high inflation-high Government involvement)
	Billion dollars	
1980	75.2	75.2
1981	84.4	84.4
1982	100.1	100.1
1983	113.4	115.0
1984	130.9	135.3
1985	146.1	155.4
1986	164.3	183.0
1987	183.1	215.3
1988	201.1	253.5
1989	218.4	298.2
1990	234.0	351.8
1991	251.3	416.7

The effect of future structural changes in interest rates on the lending role of CCC will depend primarily on the difference between CCC rates and those of alternative loan sources. A narrowing margin between these two interest rate categories will tend to lessen the reliance of farmers and farm marketing cooperatives on CCC loans.

CCC Lending During the Eighties

Under the "most likely" economic projections for the eighties, CCC loans are expected to increase as total debt requirements increase, but the relative share of nonreal estate debt is expected to change only slightly over the period—averaging between 6 and 8 percent of total debt outstanding (table 3). This represents a continuation of the reduced role in the use of CCC loans as was the case in the seventies. With less desirable economic conditions (continued stagflation), the picture is somewhat different. With lower farm income and equities, private lenders are likely to reduce their proportion of farm lending, thereby increasing the proportion of Government lending including that of the CCC. The share of CCC nonreal estate debt could be expected to increase from near 6 percent in 1980 to near 20 percent by 1991.

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rmers' Alternatives to Debt Financing

ohn B. Penson, Jr., and Marvin Duncan*

Abstract

The importance of leasing and outside equity financing is likely to grow in the eighties if farmers find it increasingly difficult to debt finance the rising costs of land and equipment. Information on the magnitude of equipment leases and outside equity financing, now lacking, is needed to monitor the changing financial structure of the farm sector. Farmers should carefully consider the after-tax cost of capital and cash flow constraints when choosing between lease financing and debt financing. Unless blocked by public policies, investment in farming by nonfarmers could grow rapidly. Increased leasing and entry of outside equity capital have important implications for the future ownership and control of agriculture.

Keywords: Operating leases, Financial leases, Outside equity capital, Financial structure, Incorporation, Joint ventures, Limited partnership

roduction

wing capital spending projected for the farm or during the eighties will place increased pres- on farmers' credit reserves. Hughes projects both real estate debt and nonreal estate debt tanding in the farm sector must more than tri- to meet farm capital expenditures projected for eighties.[1] New entrants, in particular, will find creasingly difficult to debt-finance the purchase e capital inputs they need. In this article, we mine two alternatives to debt financing avail- to farm operators who want to acquire addi- al capital services.

first alternative is leasing. Farmers, for exam- can use an operating lease to acquire use of nland or to acquire the services of tractors, cks, combines, irrigation equipment, silos, and n cows. The lessor may be the farmer's local ker. Manufacturers and leasing companies also e machinery and equipment as well as storage lities. The second alternative to debt financing ff-farm equity capital. Limited partnerships, ven- e companies, joint ventures, and incorporation all represent potential means through which farmers can attract off-farm equity capital to finance the acquisition of farm assets they may not be able to debt-finance.

Both approaches to financing the acquisition of capital services currently play a much more significant role in other sectors of the U.S. economy than they do in the farm sector. In light of the economic climate projected in Hughes' baseline scenario for the eighties, however, we conclude that leasing and off-farm equity financing will play a greater role in the farm sector than they did in the seventies. How much greater will depend on the annual rates of inflation, rates of interest, and rates of return on alternative forms of investment eventually realized in the decade ahead.

Leasing

Leasing, long a viable means of acquiring the use of farmland, is being used more and more to acquire the use of other types of farming assets as well. This section reviews the historical importance of leasing in the farm sector, discusses the factors which influence the demand for leased capital, and examines the potential popularity of leasing in the eighties.

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he authors are, respectively, a visiting scholar and an assis- vice president and economist at the Federal Reserve Bank of sas City.

ee the article by Hughes in this issue.

Historical Perspective

Because their magnitudes and terms differ so greatly, we shall review the importance of leasing farmland apart from the leasing of other farming assets.

Farmland. Land is typically leased for 1 year at a time using an operating lease. The lessor either receives a fixed cash payment or shares in the profits from agricultural production. It is not uncommon, however, for such an agreement to be renewed annually over a period of many years. Slightly more than one-third of the land in farms is owned by individuals outside the farm sector who lease it to farmers. This percentage has been increasing steadily since 1950, when 29 percent of land in farms was leased from individuals outside the sector. Another 5-7 percent of the land in farms is leased from one farmer to another *(7)*.[2] The net rent paid to nonoperator landlords (people who don't farm and farmers who rent to other farmers) increased from $1.12 billion in 1960 to $4.71 billion in 1978 *(10)*. Thus, the leasing of farmland is neither insignificant nor new.

Published data also allow us to examine who is leasing farmland. For example, 42 percent of the real estate capital gains on farms with cash sales of $100,000 or more went to nonoperator landlords, with the remaining 58 percent of these gains going to farmers *(10)*. At the other end of the spectrum, only 4 percent of the real-estate capital gains on farms with cash sales of less than $2,500 accrued to nonoperator landlords. Thus, leasing of farmland is much more significant to operators of large-sized farms than it is to operators of small-sized farms.

Other Farming Assets. The services of other farming assets can also be leased. While operating leases may be used in some instances, the use of financial leases appears to be increasing dramatically *(3)*. An operating lease and a financial lease differ principally in their cancelability. A farmer can cancel an operating lease after giving proper notice to the lessor. A financial lease, however, is a noncancelable contractual commitment by the farmer to make a series of periodic lease payments to the lessor. Thus, a financial lease in some respects is much like 100-percent financing.

Data from the *1974 Census of Agriculture* indicate that nonoperator landlords owned 5 percent or less of farming assets other than land. It is not known what proportion of these assets owned by nonfarmers was leased to farmers, however. A 1979 na tional survey of equipment lessors suggests that the use of leased equipment increased sharply throughout the economy over 1976-78 *(1)*. For exam ple, the total cost of equipment leased rose 13.6 pe cent from fiscal year 1976 to fiscal year 1977 and 3 percent from fiscal year 1977 to fiscal year 1978. Even in real terms, leased equipment costs rose 6. percent and 24.4 percent, respectively. The survey also indicated that approximately 5 percent of the equipment leases outstanding at the start of 1978 was agricultural equipment—about $1.1 billion. Thi is a rather insignificant figure when one considers that the stock of farm machinery and motor vehicles at the beginning of 1978 was $77.1 billion *(10)*.

Agricultural equipment leasing is still a minor part of the leasing industry. Office machinery and equip ment (including electronic data processing equipment), production equipment, and transportation equipment made up two-thirds of the equipment leased in fiscal year 1978. Even hospitals accounte for 7 percent of leased equipment, a larger share than farmers. Recent statements by equipment lessors, however, indicate that farmers are showin an increasing interest in equipment leasing *(3)*.

Finally, the national survey indicated that none of the respondents to the survey questionnaire lease agricultural equipment costing less than $10,000. The cost of such equipment was split almost evenl between the $10,000-$50,000 and the $50,000-$250,00 categories.

Factors Influencing Demand

Perhaps the most obvious advantage of leasing is that it permits a farmer to acquire the use of an asset without having to make a sizable initial outl of equity capital. Farmers are generally asked to prepay their annual lease payment before they ca take control of the asset. But this payment is gene ally substantially less than the downpayment required for debt financing. This is particularly true in the case of farmland. In 1978, for example, Illino farmland rented for $92 per acre on a cash rent basis, only 4.3 percent of its current market value *(12)*. If farm operators were to debt finance the pu e of this land, they likely would have had to e up with 20 percent or more of its current mar- value as a downpayment. This advantage of ng has particular appeal to beginning farmers ell as to those with limited equity capital who striving to achieve economies of size in their ations.

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[2] Italicized numbers in parentheses refer to items in the Literature Cited at the end of this article.

econd advantage relates to the treatment of the e payment as a deductible expense for Federal me tax purposes. When farmers lease farmland, example, the total cost of the land is amortized the lease payment. By deducting the lease pay- t as an expense, farmers can substantially ice their annual income tax liabilities. Because ners purchasing farmland cannot depreciate it heir Federal income tax return (any interest nents are deductible, however), this can repre- a significant tax advantage. The higher the ner's marginal tax rate, the greater this advan- will be. Hence, the extensive use of leased nland by operators of large-sized farms who also the highest net farm income is not surprising This tax advantage is much less significant in case of depreciable assets, as farmers purchas- these assets can use accelerated depreciation hods to write off the cost of the asset over its ul life. After considering investment tax credit, reciation recapture, and other tax considera- s, however, Harl suggests that "income tax fea- s might tip the balance in favor of leasing" *(6)*.

mers should evaluate the effects the tax advan- will have on them specifically in light of the ginal tax rates they expect to pay over the life he leasing agreement. They should also make that a leasing agreement for depreciable ts is not considered a conditional sales contract he Internal Revenue Service.[3]

sing also may be the only way some farmers can uire the use of a particular asset. For example, a ner may find that the only additional land avail- within a reasonable distance is being offered lease rather than sale.

A potential advantage of using a financial lease for machinery and equipment is that the cost of capital remains constant over the life of the leasing agreement. In periods of rising interest rates, using variable rate loans from such financial intermediaries as Production Credit Associations or using shorter loan terms to debt finance the purchase of an asset would expose farmers to rising financial charges.

Farmers can use a financial lease for machinery and equipment to gain another advantage; leasing allows them to put their equity capital where it earns the greatest return. They may be able to achieve faster equity growth by leasing depreciable equipment instead of buying it and using their equity capital to help debt finance the purchase of farmland or other assets which appreciate in value.

Other purported advantages of financial leases appear largely illusory. For example, Barnes states that "ownership of equipment often makes replacement difficult prior to the time that obsolescence becomes an economic problem" *(2)*. While this may represent an argument for using an operating lease, lease financing provides no more flexibility than debt financing. The farmer has a fixed obligation to make periodic lease payments regardless of whether or not the asset becomes obsolete. There is nothing flexible about a long-term noncancelable leasing agreement. In fact, a farmer who buys an asset can sell it if it becomes obsolete. This is not an option for the farmer who leases and thus does not hold title to the obsolete asset.

Leasing imposes several disadvantages. The interest cost of financial leases can be as much as 3 or more percentage points higher than the interest rate on debt financing. Any residual value of the asset goes to the lessor, not the lessee. Consider farmland, which can greatly appreciate in market value in just a few years. While farmers leasing land earn production income from the services it provides, they do not participate in the unrealized capital gains which accrue entirely to nonoperator landlords. Farmers should weigh the appreciation foregone when evaluating the desirability of leasing an asset with significant residual value.

In the case of financial leases, the farmer may be able to stipulate an option either to renew the lease or to purchase the asset when the leasing agreement matures. If the purchase option is specified in the initial agreement, the farmer can obtain a hedge against rising asset values. For example, a dairy

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genuine lease must meet the following conditions: (1) the e period must be less than 30 years; (2) the periodic lease pay- t must represent a reasonable return to the lessor; (3) if there repurchase agreement, the farmer must equal or exceed an from a bona fide third party; and (4) a renewal option, if red, must be bona fide, and the farmer must be given the first rtunity to match a bona fide offer by a third party.

farmer leasing a cow for a 5-year period may have the option of buying the cow for, say, 20 percent of its original price at the end of the fifth year. Certain equipment leases also allow the lessee to obtain the proceeds from the sale of the equipment when the leasing agreement matures *(14)*.

How can farmers account for all these factors when selecting between debt financing and leasing? One approach is to compare the after-tax cost of debt financing with the after-tax cost of leasing.[4]

Such an analysis accounts for the effects of the tax depreciation allowance, the farmer's tax rate, the size of the annual lease payment, and what effect the purchase price of the equipment has upon the borrow-versus-lease decision. The higher the farmer's marginal tax rate or the higher the cost of debt financing, the more attractive leasing will be. Farmers should also determine whether or not either alternative would cause their cash outflows to exceed their cash inflows. Debt financing could be preferable to lease financing because of its lower after-tax costs and yet not be feasible from a cash flow standpoint.

Finally, farmers who seek lease financing should expect to have their financial position examined as thoroughly as if they were seeking debt financing. Farmers should note in the asset section of their balance sheet the capitalized value of their rights to the use of leased assets and in the liability section their current and long-term obligations under leasing agreements. Neither of these values is normally included in the asset and liability totals in this statement, however *(8)*.

Future Popularity

To evaluate the potential popularity of leasing during the eighties, let us look at what will likely happen to the factors which affect the demand for leasing by farmers and the factors that will affect the supply of leasing services by leasing companies, financial intermediaries, and individuals.

Future Demand. On the demand side, we can expect to see a number of new entrants in the farm sector given the advancing age of the country's average farmer. According to the 1974 Census of Agriculture, 44 percent of farmers were age 55 years or older *(13)*. These farmers, who own about 45 percent of the farmland, will reach retirement age by the middle of this decade. Thus, the proportion of new farmers, who have a low equity in their businesses, will likely increase. Today, a beginning farmer may need to control assets of up to $1 million in order to generate a family income competitive with investment opportunities available outside the farm sector.

It's very unlikely that many new entrants will have enough credit reserves to debt finance all their capital needs. At a minimum, many will have to lease some land. If interest rates on loans remain high and variable, some risk-averse farmers may also prefer to lock in a fixed cost of capital by acquiring the services of equipment through a financial lease rather than by borrowing under a variabl rate loan. As stated earlier, however, farmers should expect lessors to carefully examine their payment capacity. Finally, higher farm incomes as well as farm programs which place a floor under real returns to farmers in periods of inflation will increase their marginal tax rates, thus making leasing more attractive.

Future Supply. As many older farmers retire they could withdraw a significant amount of equity capital. Continued high interest rates may make it difficult for some sellers to withdraw their equity at the market price they desire, however. This, coupled with their desire for a hedge against inflation, may convince them to lease their property to others and stay in farming as nonoperator landlords.

During the eighties, three factors will likely attrac investors outside the farm sector to invest in farm land and lease it to others.

First, inflation has caused investors to view physic assets as a more desirable store of value than fina cial assets. This judgment has proven correct in th case of farmland where increases in value during r cent years have outpaced inflation. Even though a farm recession and high interest rates may mome tarily reverse that pattern for 1980, it is likely to be reestablished in the remainder of the decade. I inflation were to continue at uncomfortably high rates, even greater numbers of off-farm investors might look to farmland as a hedge against inflatio

Second, foreign investors have become increasingl interested in U.S. farmland. This is likely the resu

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[4] Alternatively, one could compare the present value of the cash outflows associated with these two alternatives.

number of factors, including relatively higher
opean land prices, difficulty in finding land
lable for purchase in other countries, and large
eases in dollar holdings by oil exporting coun-
s. The declining value of the dollar against some
r major currencies also has made U.S. assets at-
tive to foreign investors, and has enabled them
urchase assets like farmland at effectively lower
es than are available to U.S. citizens. Finally,
igners owning U.S. farmland have in some in-
ces received preferential tax treatment not
lable to Americans when selling property. While
ign investment in U.S. farmland has been much
ussed, however, the amount of property in-
ed is relatively small. Less than one-half of 1
ent of the U.S. farmland was owned by for-
ers in 1978 *(11)*. Thus, leases between farmers
domestic nonfarmers are likely to continue to
tly exceed those with foreign landowners.

rd, the growing demand for foodstuffs projected
ing the eighties could increase returns from in-
tment in farming to levels which compare favor-
with returns on alternative investments. If
rns to farm investments become more favor-
, farmland may become increasingly attractive
ndividual investors, investment groups, and pen-
plans. This will be particularly true if—as ex-
ted—current returns to farming increase
kedly and if farmland continues to effectively
lter equity from inflation.

mers and policymakers thus far have attempted
iscourage such outside investment. In 1977, the
tinental Illinois Bank of Chicago and Merrill,
ch, Pierce, Fenner, and Smith, Inc., attempted
reate a pooled farmland trust for purchase by
itutional investors such as pension funds. The
d would have purchased blocks of farmland,
sed them to farmers for a number of years, and
n sold the land to realize capital gains. Wide-
ead opposition to such a plan by the Congress,
te legislatures, and farm groups caused these
ncial firms to drop the proposal. However, while
current returns in the farm sector and wide-
ead public opposition have thus far kept pension
ds out of farmland, more corporate investors are
ting involved *(5)*. A number of major insurance
panies, as well as certain investment organiza-
s, have recently expanded their ownership of
mland. And, it seems likely that pension funds
overcome their reluctance to own farmland if
farm sector becomes as profitable in the
hties as many observers suggest.

Indeed, the American Agricultural Investment Management Company (AAIM), an Illinois-based firm, recently proposed investing employee pension funds in farmland *(4)*. Under their plan, a pension fund would own specific agricultural properties rather than an interest in a farmland investment portfolio. The investment would be managed by AAIM acting as an intermediary. Responding to this and similar proposals, the U.S. Department of Agriculture (USDA) has suggested the need for revisions to the Federal tax law that would alter the tax-exempt status of farm income and capital gains from farmland earned by a tax-exempt pension fund through an intermediary *(4)*. One proposal is to view this income as taxable if it would be taxable when earned by the tax-exempt fund itself. Most farm organizations agree that such a change to the Federal tax law is needed to prevent unfair competition for farmland by tax-exempt investment funds.

A variety of institutions offer financial leasing services to farmers. They include commercial leasing companies, lenders, and companies manufacturing the asset being leased. Commercial leasing companies, for example, generally deal directly with farmers, although some prefer to participate with banks in making financial leases.[5] Some banks also offer their own financial leasing programs to farmers and participate in leases with their correspondent banks. Manufacturers of agricultural structures and equipment provide financial leases to farmers through local dealers.

The factors which attract these lessors to lease financing include: profits, the ability to keep customers they might otherwise lose, and tax advantages in the form of accelerated depreciation allowances and investment tax credit. Lease financing can help banks retain customers they would otherwise lose because of legal lending limits. Manufacturers of high-priced storage facilities and equipment may find lease financing a profitable complement to outright sales. Leasing also can be attractive because, unless title to the asset is transferred to the lessee at the end of the agreement, the residual value of the asset provides the lessor a hedge against inflation.

Structural Implications. The growing role of nonoperator landlords in leasing land to farmers has an important implication for the structure of the farm sector. With more nonoperators leasing land, the proportion of unrealized real estate capital gains accruing to farmers will shrink. This source of equity gains has enabled farmers in the past to increase their use of debt financing and yet maintain a low leverage ratio. Several structural changes may also take place in the loan funds market serving agriculture.

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[5] According to one leasing firm, "A bank participant can take up to 75 percent of the lease. Our minimum share is 25 percent" (*3*, p. 24).

For example, nonreal estate loans made by merchants and dealers will decline to the extent that manufacturers, who, in response to the income potential and tax advantages of leasing, become involved in lease financing at the expense of their lending operations. To the extent commercial banks and other private lenders develop leasing programs on their own or in participation with others, their activity in the loan funds market may also diminish. The principal effect on these lenders, however, will be to alter their financial statements. Total loans made and interest income may be less, but the increased financial leasing will be reflected in the growth and profitability of their leasing companies.

Better Data on Leasing Needed

Recent national surveys of machinery and equipment lessors verify the growing role played by financial leasing in the U.S. economy. There is every indication that its importance to the farm sector will grow as well. Therefore, users should recognize that the USDA's farm-sector income *(10)* and balance sheet *(9)* statistics do not reflect the services or obligations associated with financial leases.[6] For example, the stock of machinery and motor vehicles in the sector's balance sheet is updated by information obtained from annual farm expenditures surveys. These surveys obtain information on purchases of farm tractors, for example, but not on farm tractors leased from firms outside the sector.

One reason why this omission is important is that measurement of input use in USDA's productivity index, and in studies calculating production elasticity estimates, is partly based on this stock of machinery and its depreciation. This omission causes an overstatement of the productivity of agriculture as depicted by the ratio of outputs to inputs and an understatement of the role of capital in factor share studies.

The sector balance sheet currently treats lease financing in the "off balance-sheet" manner typical of accounting practices followed by firms in the fifties and sixties, where financial leases were not disclosed. Rulings by the Financial Accounting Standards Board have brought about enough disclosure to enable financial statement users to judge the impact of all financial commitments, including financi leases. A financial statement with future financial lease obligations omitted looks deceptively better than one including assets purchased and debt financed.

If, for example, the future lease payments farmers are obligated to pay under existing financial leasin agreements (which are just as real as debt payments) are omitted from the liability section, resulting debt-to-equity ratios will understate farmers' leverage positions and exposure to financial risk. Similarly, use of the cash-flow coverage ratio, (the ratio of cash earnings before interest and taxes for a particular period to loan payments (principal and interest) during the period), will give a faulty reading of farmers' ability to service long-term liabilities. This ratio would overstate farmers' ability to meet their long-term obligations because there is n accounting of financial leases. Because of these problems, we believe USDA should initiate efforts to obtain information on financial leases from machinery and equipment lessors. Otherwise, analysts will not stay abreast of changes in the financial structure of the farm sector.

Off-Farm Equity Financing

This section examines farmers' use of off-farm equity capital to finance the purchase of variable production inputs and the purchase of fixed capital items in which the farmer retains a partial ownership claim.

Off-farm equity capital has played a significant rol in the livestock subsector in recent years. Investor ownership of cattle on feed, of hog farrowing and finishing facilities, and of some assets in poultry production has become significant.

Farmers have been of two minds regarding the entrance of such capital. They have usually welcome new sources of capital—especially if the terms are favorable. But most farmers have consistently viewed outside equity capital with distrust, especially when farmland is involved. U.S. public opini

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[6] They do reflect the farming assets owned by nonoperator landlords. For example, they capture farmland leased by farm operators from nonoperator landlords.

ended to support the latter view, and many
s have enacted legislation restricting outside
y investment in farmland by both foreigners
domestic corporations. New economic circum-
es and changing public attitudes, however,
serve to create a more favorable climate for
uture entry of off-farm equity capital.

rtunately, complete data are not available to
ate the role of off-farm equity capital in financ-
gricultural production and expanding the equi-
se of existing firms.

ors Favoring Off-Farm Equity Financing

mber of factors favor an increasing use of off-
equity capital in the eighties. For example, in-
on and advancing agricultural technology have
tly increased the cost of entry into farming.
entrants are likely to need more equity capital
they have. Unless they can get enough help
their families, new entrants may need equity
al supplied either by retiring farmers or by
rs outside the farm sector.

ddition to providing needed equity funding, off-
equity capital enables farmers to share busi-
risks with others. For example, off-farm owner-
of livestock spreads the risk of death loss and
ase. Thus, judicious use of off-farm equity capi-
s a way for farmers to gain an ownership inter-
n the assets needed for an efficient operation
out assuming the risk associated with full
ership.

lems to be Resolved

stments in farm assets are frequently not as
d as other types of investment opportunities.
market is much narrower, with fewer prospec-
buyers and sellers than for financial assets.
s and returns are less well defined. Finally, the
ess of a venture may be linked to the manage-
t ability of an individual farmer or to the
ngth of a specific commodity market. Hence,
an investment may require a higher risk pre-
m than would financial assets.

m the perspective of the farmer interested in at-
ting off-farm equity capital, some problems re-
n to be resolved. Locating prospective investors
providing them with a convincing prospectus,
satisfying securities laws are time-consuming and expensive—probably too expensive for most individual farm firms. Even if a farm firm complied with securities laws and was incorporated, outside investors might hesitate to assume minority interests in a closely-held farm. Such minority positions negate management control of the investment and could prove difficult for the investor to sell.

Despite potential problems with the marketing of equity interests in farm firms, other means of attracting off-farm equity capital may be attractive to investors. Limited partnership agreements, which include a general partner along with one or more limited partners, have proven particularly successful. The general partner (a farmer or an investment firm) typically assumes management responsibilities and an unlimited liability in case of loss. Limited partners share in the partnership's venture, but have no management responsibility. Their potential loss, however, is limited to the amount they have invested. Limited partnerships in livestock production and in vineyards, for example, have proved to be a successful means of attracting off-farm equity capital into the farm sector. Tax shelter considerations are important to potential investors, but even more important is the potential for generous profit margins. Use of limited partnerships in cattle production has declined in recent years, apparently the result of limited profit opportunities. Thus, without high profits, farmers may have limited success in attracting off-farm equity capital through the use of limited partnership agreements.

Venture companies may offer a growing opportunity to attract off-farm equity capital into the farm sector. It is likely such firms would invest in farmland, facilities such as farrowing and finishing houses, and livestock, and then offer leases or lease-purchase agreements to farmers. Such firms could offer investment packages composed of a given number of brood cows, feeder cattle, or feeder pigs to off-farm investors, who would share in profits and losses while retaining the right to decide when to sell their investment unit. It seems less likely that venture companies would be interested in purchasing minority interests in closely-held farm corporations.

Joint ventures among farmers or between a farmer and a small business investment company (SBIC) represent another device for attracting off-farm equity capital. For example, several farmers can jointly buy a combine and share its services, even though individually none could have justified buying it.

The pooling of farmland and other farm assets into a larger business unit controlled by several owners may also afford some farmers the economic benefits of an efficient-sized operation not otherwise possible. A number of SBIC's are apparently supplying outside equity capital to farmers. An SBIC is licensed under the Small Business Investment Act of 1958 and regulated by the Small Business Administration (SBA). The SBIC can borrow from the SBA up to four times its private capital. The SBIC's are authorized under a 1976 amendment to the Small Business Act to invest in "agricultural production activities" among other alternatives. However, the role an SBIC can play in providing equity capital to the farm sector in the eighties may be limited. Such firms are limited in their ability to provide equity capital for the purchase of farmland.

A final source of off-farm equity capital that may receive a greater play in the eighties is the supply of equity capital by firms that either provide variable production inputs to farmers or process and market the raw products they produce. This interest, which appears limited primarily to production financing to date, benefits the outside firm by giving it some control over the growth of input sales to farmers or the flow of products supplied to it by farmers. A possible additional benefit if longer term capital is provided could be a sharing of the growing equity position of the farm firm. However, there are some difficult barriers to investment in the farm sector by corporations. Furthermore, this use of funds might be viewed with some suspicion by corporate management and boards of directors who are typically more oriented toward shortrun performance rather than longrun capital appreciation.

Conclusions

Capital needs in the farm sector are projected to grow even more rapidly during the eighties than they did in the seventies. A greater turnover of farm proprietorships than observed in past decades will further intensify capital requirements. These requirements will likely be more than can be supported by the equity position of those desiring to enter the farm sector. Meanwhile, demand for farm assets by off-farm investment groups should be increasing as well. Consequently, leasing and outside equity capital invested in the farm sector could grow rapidly during the eighties.

As a consequence, the financial structure of the farm sector may change dramatically. The proportion of farmers carrying heavy debt loads will increase as virtually debt-free farmers retire and are replaced by new entrants with small equities in their businesses. Retiring farmers may find it necessary to leave part of their equity in the sector And, the ownership position in the sector by nonfarmers may increase markedly if farm assets become more attractive investment options. This, o course, means that a smaller proportion of unrealized capital gains in the sector would accrue to farmers. Thus, the current outlook would suggest that farm financial structure in the years ahead wil be much more like other sectors of the U.S. economy.

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'he Economic Recovery Tax Act of 1981: ;onsequences for Farm Operators

y Clair J. Nixon and James W. Richardson*

Abstract

The passage of the Economic Recovery Tax Act of 1981 will enable most continuing farm operators to realize a significant reduction in their income tax liabilities. FLIPSIM II was utilized to simulate a typical farm in the Texas Southern High Plains with a resulting tax savings of $20,000 over a 10-year planning horizon.

Keywords: Tax, Simulation

ntroduction

he Economic Recovery Tax Act of 1981, the most massive x reduction bill in recent history, was signed into law on ugust 13, 1981. While the overall effect of the new act is educed income tax liabilities, the effect on individuals in ie agriculture sector has not been fully assessed. This paper lentifies the likely effects of the new act on individual farm perators and discusses how they can receive the maximum enefit under the new law. A computer simulated case farm xample is presented to show the effect of the new act on rm operator depreciation deductions and income tax abilities over time.

Vhile not all of the provisions in the new act are addressed i this paper, those changes which will likely have a significant impact on continuing farm operators are discussed. 'hese changes in the tax law include: individual tax rate eductions, an accelerated cost recovery system replacing ie old depreciation methods, and liberalized investment ax credit and investment tax credit recapture rules. In many ases, both the old law and new law will be presented to how the magnitude of the change that has occurred.

ndividual Tax Rate Reduction

)ctober 1, 1981, signaled the beginning of the individual ncome tax rate reductions. The rate reduction affected 981 taxable income by applying a credit of 1.25 percent to he tax computed on 1981 income. Additional tax rate reluctions for 1982, 1983, and 1984 are shown in table 1. 'he cumulative effect of the rate reductions will be 10 percent in 1982, 19 percent in 1983, and 23 percent in 1984. For tax years beginning in 1985, the individual income tax brackets, zero bracket amount, and personal exemptions will be adjusted for inflation based on changes in the Consumer Price Index (CPI).

For high-income tax bracket farm operators, the effect of the new act is an immediate reduction in the maximum tax rate from 70 percent to 50 percent on both earned and unearned income. This reduction eliminates the 50-percent maximum tax on personal service (earned) income. A corresponding reduction from 25 percent to 20 percent was also made for the maximum rate on alternative minimum taxable income exceeding $100,000.

With the dramatic reductions in the income tax rates, farm operators should consider the income tax and cash flow implications of postponing the recognition of income into later tax years. Of course, the level and type of income (ordinary or capital gain) should also be considered when developing an optimal income tax recognition strategy. For example, a married farm operator filing a joint return with taxable income of $60,000 will pay $17,705 in income taxes in 1982 (see table 1). However, in 1984, that same $60,000 of taxable income will only be assessed $15,168 in taxes. At higher income levels, the tax savings become even more significant. Yet, postponing income recognition for most cash-basis taxpayers results in not using that income until it is recognized. Therefore, to accurately assess the benefits of postponing income recognition in anticipation of reduced future tax rates, the present value of the tax savings should be compared with the opportunity cost of foregoing the use of income presently.

If deferring the recognition of income is not a reasonable possibility, the acceleration of expenses in the current year can also effectively reduce taxable income. Furthermore, sales of crops and livestock in January rather than December (for calendar year taxpayers) allow farm operators to use the funds from the sale for almost an additional year before paying taxes, and have the income taxed at reduced future rates. Thus, prepayment of expenses and/or postponement of income recognition can help farm operators receive maximum benefit under the new law.

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Accelerated Cost Recovery System

For capital intensive sectors such as agriculture, the 1981 Act made significant changes in the rate at which the cost of most newly acquired depreciable assets (post-1980) may be recovered (depreciated).[1] The accelerated cost recovery system (ACRS) will be used for most depreciable assets and will replace other depreciation methods including the class life asset depreciation range (ADR) system, component depreciation, and facts and circumstances. Depreciable assets are identified by their class life category of either 3, 5, 10, or 15 years. Table 2 shows the recovery percentages using the new accelerated method for personal property for 1981-84. For agriculture, the 3- and 5-year classes are most important. The 3-year class includes light trucks, automobiles, over-road tractors, breeding hogs, racehorses more than 2-years old and other horses over 12-years old when placed in service, and personal property with an ADR mid-

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[1] Depreciable assets acquired prior to 1981 will continue to be depreciated under the old law. There is also some property that will not be subject to ACRS even if it is placed in service after 1980. For example, certain property acquired from parents does not become ACRS property. In addition, property the taxpayer elects to depreciate under a method not expressed in terms of years will not fall under ACRS, such as machinery depreciated under the unit-of-production method.

Table 1—Tax rate schedules, joint returns, 1980-84

Taxable income bracket	Old tax law		New tax law[1]					
	1980		1982		1983		1984 and subsequent years	
	Tax at low end of bracket	Tax rate	Tax at low end of bracket	Tax rate	Tax at low end of bracket	Tax rate	Tax at low end of bracket	Tax rate
	Dollars	*Percent*	*Dollars*	*Percent*	*Dollars*	*Percent*	*Dollars*	*Percent*
$0-$3,400	0	0	0	0	0	0	0	0
$3,400-$5,500	0	14	0	12	0	11	0	11
$5,500-$7,600	294	16	252	14	231	13	231	12
$7,600-$11,900	630	18	546	16	504	15	483	14
$11,900-$16,000	1,404	21	1,234	19	1,149	17	1,085	16
$16,000-$20,200	2,265	24	2,013	22	1,846	19	1,741	18
$20,200-$24,600	3,273	28	2,937	25	2,644	23	2,497	22
$24,600-$29,900	4,505	32	4,037	29	3,656	26	3,465	25
$29,900-$35,200	6,201	37	5,574	33	5,034	30	4,790	28
$35,200-$45,800	8,162	43	7,323	39	6,624	35	6,274	33
$45,800-$60,000	12,720	49	11,457	44	10,334	40	9,772	38
$60,000-$85,600	19,678	54	17,705	49	16,014	44	15,168	42
$85,600-$109,400	33,502	59	30,249	50	27,278	48	25,920	45
$109,400-$162,400	47,544	64	42,149	50	38,702	50	36,630	49
$162,400-$215,400	81,464	68	68,649	50	65,202	50	62,600	50
$215,400 and over	117,504	70	95,149	50	91,702	50	89,300	50

[1] The tax rate schedule for 1981 is the same as 1980 except that a 1.25 percent credit is allowed against the 1981 tax liability. Compared wit the 1980 law, tax rates are reduced approximately 5 percent in 1981, 10 percent in 1982, 19 percent in 1983, and 23 percent in 1984.

Source: Economic Recovery Tax Act of 1981, Public Law 97-34.

›int life of 4 years or less. The 5-year class includes most her machinery and their complements, heavy-duty trucks, estock not included in the 3-year class, and single-purpose ricultural and horticultural structures such as greenhouses d farrowing pens. Most farm personal property falls in the year class. These class life categories are the same whether e asset is new or used. Salvage value is also no longer nsidered in the depreciation computation. Thus, the numr of contested depreciation life cases between taxpayers d the IRS (Internal Revenue Service) should decrease amatically.

nere is a phase-in period for depreciable personal property ıder the ACRS. The first period is 1981-84, where the celerated method uses the 150-percent declining-balance ethod in the early years and switches to the straight-line ethod for the remainder of the recovery period. For 1985, e 175-percent declining-balance method is used for the ırly years with a switch to the sum-of-the-years digits ethod thereafter.[2] For property placed in service after 985, the 200-percent (double) declining-balance method is ›ed in the early years with a switch to the sum-of-the-years gits in later years. In addition, the half-year convention is tilized in the year of acquisition and is built into each of ıe recovery tables. The half-year convention allows taxayers one-half of the first year's cost recovery no matter hen the asset was acquired during the year. This provision is especially important to farm operators who generally purchase their machinery near the end of the year. Under the old law, if a tractor was purchased in December, it received only a single month's depreciation in that year unless the farm operator elected the half-year averaging convention.[3] Thus, farm operators can now wait until the end of the year to purchase depreciable assets and still receive 6 months' worth of depreciation expense in that year.[4]

Table 2—Recovery percentages for personal property, 1981-84

f the recovery year is:	The applicable percentage for the class of property is:			15-year public utility
	3-year	5-year	10-year	
1	25	15	8	5
2	38	22	14	10
3	37	21	12	9
4		21	10	8
5		21	10	7
6			10	7
7			9	6
8			9	6
9			9	6
10			9	6
11				6
12				6
13				6
14				6
15				6

Source: Section 201, Economic Recovery Tax Act of 1981, ›ublic Law 97-34.

For the farm operator who may not currently need larger depreciation (cost recovery) allowances, longer recovery periods for each class of assets are available. Property in the 3-year class can be recovered in 5 years or 12 years, while property in the 5-year class can be recovered in 12 years or 25 years. The straight-line depreciation method must be used for these extended recovery periods, however. In addition, the same class period must be elected for all personal property of the same class put into service in that year. Furthermore, a farm operator who elects to use the straight-line method of recovery must also elect it for all property of that class placed in service for the year the election is made.

Depreciable real property with an ADR midpoint life greater than 12.5 years has been assigned a 15-year recovery period (table 3). The taxpayer has the option of using the straight-line method or the 175-percent declining-balance method with a switch to the straight-line rate in later years. Table 3 does not use the half-year convention but rather computes the recovery based on the months the asset was placed in service. Individuals may also choose to use an extended recovery period of either 35 or 45 years. If an extended recovery period is elected, depreciation must be computed on the straight-line basis.

The depreciation recapture rules still apply for the disposition of both personal and real depreciable property. The excess of the sales price over the adjusted basis up to its original cost will be recaptured as ordinary income on all depreciable personal property regardless of depreciation method used and on nonresidential real property for which the accelerated method is elected.[5]

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[2] The declining-balance, sum-of-the-years digits, and straight-line depreciation methods are used in various combinations over the phase-in period. The standard computation procedure for these depreciation methods has not changed, except that salvage value is no longer included.

[3] Yearend purchases by farm operators under the old law often resulted in no depreciation allowances in the current year if the purchase was made after December 15. This is assuming the farm operator utilized the monthly convention, that is, acquisition prior to the 15th of the month received a full month's depreciation; after the 15th, no depreciation was allowed for the month.

[4] The new ACRS is a disadvantage to farm operators who purchase depreciable assets in the first half of the year because they will still only receive 6 months of depreciation in the first year.

The new method of computing depreciation will further widen the gap between accounting for financial statement purposes and for tax purposes. This is because generally accepted accounting principles (GAAP) still require that assets listed on financial statements be depreciated over their estimated useful life with salvage still a part of the computation.

Another important change in the new law is that additional first year (bonus) depreciation has been replaced by an election (option) to immediately expense a portion of new or used personal property. The amount of expensing is limited to $5,000 in 1982 and 1983, $7,500 in 1984 and 1985, and $10,000 in 1986 and thereafter. The special expensing provisions apply to property which is eligible for investment tax credit. The amount of an asset expensed in any year reduces its basis for cost recovery under ACRS. In addition, the amount expensed is treated as depreciation for purposes of the recapture rules. The portion of an asset which is expensed does not qualify for the investment tax credit, however. The effect of this provision will be discussed later.

There appears to be more flexibility in determining annual depreciation allowances under the new law than there was under the old law. Farm operators can now effectively manage their depreciation deductions to maximize their benefit when the deductions are needed most. This is especially true of entering farm operators who may not need large depreciation deductions currently, but will likely need them in later years as income rises. The optional longer recovery periods might suit these young farm operators better. On the other hand, continuing farm operators facing high-income tax liabilities can reduce their liabilities through faster cost recovery.

Investment Tax Credit

The change in the investment tax credit and investment tax credit recapture rules will likely have a profound effect on the agricultural sector. The majority of the depreciable assets acquired by farm operators qualify for the investment tax credit which enables operators to reduce their tax liabilities on a dollar-for-dollar basis. Under the new law, there are only two holding periods for qualifying assets: property in the 3-year class receives a 6-percent credit on the purchase price or other basis of the asset, and property in the 5-year class receives a 10-percent credit. In essence, the holding periods were reduced by 2 years in each case. There has been no change, however, in those assets which qualify for the credit. Finally, electing a 5-year recovery period for 3-year class property does not increase the available investment tax credit from 6 percent to 10 percent on that property. Therefore, the benefits of a faster recovery period under ACRS are somewhat offset with the reduction in the investment tax credit on many pieces of farm machinery.

Farm operators will benefit from the change in the investment tax credit recapture rule. Under the old law, the full investment tax credit was recaptured if the asset was disposed of within 3 years of its acquisition. Now, a 2-percent credit is allowed for each year that the asset is held. For example, a heavy-duty truck purchased in 1982 with a 5-year class life would be eligible for a 10-percent investment tax credit in 1982. If this truck was sold in 1984, the farm operator would only have to recapture 6 percent of the original investment tax credit. Under the old law, the full 10-percent investment tax credit would have been recaptured.

Table 3—Accelerated recovery percentages for real property

Year	Month[1]											
	1	2	3	4	5	6	7	8	9	10	11	12
	Percent											
1	12	11	10	9	8	7	6	5	4	3	2	1
2	10	10	11	11	11	11	11	11	11	11	11	12
3	9	9	9	9	10	10	10	10	10	10	10	10
4	8	8	8	8	8	8	9	9	9	9	9	9
5	7	7	7	7	7	7	8	8	8	8	8	8
6	6	6	6	6	7	7	7	7	7	7	7	7
7	6	6	6	6	6	6	6	6	6	6	6	6
8	6	6	6	6	6	6	5	6	6	6	6	6
9	6	6	6	6	5	6	5	5	5	6	6	6
10	5	6	5	6	5	5	5	5	5	5	6	5
11	5	5	5	5	5	5	5	5	5	5	5	5
12	5	5	5	5	5	5	5	5	5	5	5	5
13	5	5	5	5	5	5	5	5	5	5	5	5
14	5	5	5	5	5	5	5	5	5	5	5	5
15	5	5	5	5	5	5	5	5	5	5	5	5
16	0	0	1	1	2	2	3	3	4	4	4	5

[1] Use the column for the month in the first year the property is placed in service.

Source: *Daily Tax Report*, The Bureau of National Affairs, Inc. G-4 (No. 175) September 9, 1981.

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[5] All 15-year real property is Section 1250 recapture property unless it is: (1) 15-year residential rental real property; (2) 15-year nonresidential real property for which a straight-line election is made; (3) 15-year real property used predominantly outside the United States; and (4) 15-year real property that is subsidized low-income housing.

previously indicated, expensing provisions reduce the t's basis for computing the investment tax credit. The n operator should weigh the benefits of immediate cost overy versus using the investment tax credit. In general, lower the farm operator's tax bracket, the better it is forego expensing in favor of the investment tax credit.

w that the major parts of the 1981 law affecting farm rators have been discussed, the next step is to determine what degree these changes will impact a typical farm operr's tax liability over a 10-year planning horizon.

pical Farm

e typical farm in this study is an 1,100-acre cotton farm the Texas Southern High Plains. Data to describe the ical farm were obtained from a stratified random sample producers on the High Plains. The farm consists of 385 pland acres owned and 715 acres leased on a crop-share is. Approximately one-third of the farm is irrigated. Both gated and nonirrigated cotton are produced on the farm.

terprise budgets for cotton provide the production costs l labor requirements for 1981 (*3*).[6] To calculate producn costs over the 1982-91 planning horizon, the 1981 per e costs of production were inflated annually. It was asned that input costs will increase at 10 percent per year r the planning horizon. This assumed inflation rate is listic with respect to assumed increases in crop prices.

ces of cotton lint and cottonseed were inflated at 7 pert per year from their assumed 1982 mean values of .65/lb. and $100/ton, respectively. Crop yields for irried and dryland cotton were assumed to increase at 1 pert per year from their mean values of 475 lbs. and 200 lbs. r land acre, respectively.

ms in the machinery complement for a typical farm vo sets of 8-row equipment) were identified from the m survey. Each item was assigned an age equal to the odel age observed for that particular type of machine or plement. The machinery complement for the 1,100-acre m is considered to be adequate to farm up to 1,750 acres). When a farm grows beyond this threshold, the operator ust buy an additional complement of 8-row equipment. was assumed that the market value of the new farm mainery would increase 10 percent per year while the nomal market value of used machinery would decrease 1 rcent per year.

he farm's beginning debt/asset ratio is 40 percent, the avere observed from the farm survey. Interest rates for existg long- and intermediate-term debts are reported to be about 7.5 percent and 10 percent, respectively. It is assumed that interest rates for new land and machinery loans are 12 percent and 14 percent, respectively, and that the interest rate on operating capital is 14 percent. These interest rates are consistent with the assumed rate of inflation for input costs. Interest rates charged on second mortgages are assumed to be one-half of a percentage point higher than those for comparable new loans. In addition, a 1-percent loan origination fee is charged for refinancing yearend cash-flow deficits.

A minimum family living expense is set at $15,000 in 1982 and inflated annually at 10 percent. The inflated minimum is used if it exceeds the value calculated by the consumption function.[7]

Description of FLIPSIM II

A computer simulation model (FLIPSIM II) was used to analyze the effects of the new tax law on the typical High Plains farm operator over a 10-year planning horizon. The model is a recursive, farm-level, deterministic model which simulates the production, farm policy, marketing, financial management, growth, and income tax aspects of a farm over a multiple-year planning horizon. It is deterministic in that annual crop yields and prices are determined exogenously by the user. The model is recursive in that the financial position at the end of the year is the beginning financial position for the following year.

The model calculates the standard financial activities of a farm, such as paying fixed and variable costs, making loan payments, withdrawing family living expenses, depreciating (cost recovering) machinery, and paying income and self-employment taxes. The market value of farmland is calculated annually as a function of the rate of return to production assets. This allows the value of cropland to adjust over time to the changing profitability of farms in the region. When the farm has a yearend cash-flow deficit (that is, there is not sufficient income to fully repay the operating loan) a second mortgage on farmland and/or intermediate assets is obtained.

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[6] Italicized numbers in parentheses refer to items in the eferences at the end of this article.

[7] Family size is assumed to be three members. Off-farm income from all sources is assumed to be $8,000 in 1982 and is adjusted annually by earnings of interest on excess cash balances during the period. Annual family living expenses are calculated using the following consumption function:

$$\text{Consumption expense} = 3.2315\ \text{FFS}^{0.3765}\ \text{ADI}^{0.6283}\ \text{CPI}^{0.3716}$$

where FFS is family size, ADI is disposable income, and CPI is the Consumer Price Index for all commodities and services (1967=100). This consumption function for farmers on the Southern High Plains was estimated using the SRS-USDA "Farm Operator Family Living Expenditures Survey for 1973."

If a second mortgage cannot be obtained due to excessive debts, the farm is permitted to sell a portion of the farmland to cover yearend cash-flow deficits. If adequate cash is available at yearend, the farm may grow by leasing or purchasing 160 acres of cropland. To grow, the farm must have sufficient cash reserves to pay a 40-percent downpayment for cropland and a 25-percent downpayment for the additional machinery required.

For this analysis, the farm machinery inventory is depreciated using the 5-year accelerated cost recovery schedule if purchased after 1980. All machinery acquired prior to 1981 is depreciated under the old law using the double-declining balance method and assuming a 7-year life. When machinery reaches the end of its economic life, it is traded in and replaced. The economic life of all machinery is assumed to be 7 years for the old tax law and either 5 or 7 years for the new tax law. Additional farm machinery is purchased in discrete units when the farm grows to the point where its present complement is inadequate.

Effect of the New Law

The typical farm was simulated for 10 years beginning in 1982. The farm operator used the first year expensing provisions for machinery purchased after 1981. Since the formula for computing the adjustment to tax brackets after 1984 has not been developed, the 1984 tax rates were applied to all post-1984 taxable income.

The typical farm was analyzed under both the old and new tax laws. Two simulations were made under the new tax law; the first assumed a 5-year economic life for machinery and the second assumed a 7-year economic life. No other changes regarding input data for the typical farm were made for the three simulations. The new tax law dramatically affected both the amount of depreciation deducted and the income taxes paid over the 10-year planning horizon. Table 4 shows that all three simulations had about the same net farm income, however, the annual depreciation deductions and income tax liabilities were significantly different. The accelerated nature of the cost recovery (depreciation) caused a reduction in the farm operator's taxable income. This reduction, combined with the reduced income tax rates under the new law, enabled the farm operator to save about $20,000 in income taxes over what would have been paid under the old law.

The effect of the increased depreciation deduction and reduced tax rates can be shown by analyzing the 7-year life scenario for 1985. In 1985, the farm operator had a depreciation deduction of $49,072 under the new law and $41,582 under the old law. The difference was largely due to the more rapid cost recovery of newly replaced machinery since both scenarios purchased the same equipment in 1982-91. In 1985, the income tax liability under the new law was $2,489 compared with $4,116 under the old law.

The typical farm had the same growth pattern in terms of cropland leased under the new and old tax laws; thus accounting for the similar net cash farm income in table 4. In none of the situations did the farm purchase additional cropland. Purchases of farm machinery are similar between the old tax law and the new tax law, if the farm operator trades old machinery after 7 years. If, however, a 5-year economic life is elected, machinery purchases are quite different between the two tax laws. However, a shorter economic life reduces the total income taxes paid only 3 percent over the 1982-91 period largely because of the low taxable income levels used in this example.

The average ratio in 1991 is 6 percentage points lower for the new tax law than the old tax law. This is due to the new tax act's greater rates of return to production assets, which in turn bring about greater capital gain rates for farmland. The market value of farmland in 1991 is about 10 percent higher for the new tax law scenarios. The after-tax net present value for the typical farm is about 17 percent greater under the new tax law than under the old law for both machinery life scenarios.

Summary

The Economic Recovery Tax Act of 1981 made widespread changes in the tax law which will have a dramatic effect on the income tax liabilities of farm operators. Farm operators will realize a reduction in the tax rates as well as greater depreciation deductions in the early life of most depreciable assets. Furthermore, more liberalized investment tax credit and investment tax credit recapture rules should enable farm operators to maximize the use of this credit while avoiding, to a greater extent, the effects of the recapture provisions. The recapture rule changes will be especially important to farm operators who trade in or sell farm machinery after only a few years of use.

The farm operator in the typical farm example would realize substantial tax savings over the next 10 years. The savings become even more dramatic as farm operator income rises. While the effect of the new law on each farm operator's tax liability will be different, most farmers should realize a reduction in their taxes.

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Table 4—Simulated financial position of an 1,100-acre cotton farm under the old tax law and the 1981 tax law, 1982-91

Financial position	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Dollars										
Old tax law:										
Net cash farm income[1]	46,693	54,195	66,169	76,871	88,600	90,397	91,919	95,695	94,352	92,674
Machinery depreciation	33,845	36,988	41,137	41,582	39,506	38,954	39,789	47,360	58,343	68,315
Income tax liability	0	715	1,528	4,116	10,040	11,427	12,325	6,488	3,236	2,494
Machinery purchased	72,000	74,716	75,333	28,319	34,564	75,232	68,212	140,306	145,593	146,797
Percent										
Leverage ratio	58	47	41	37	34	30	25	23	21	19
Dollars										
New tax law and 5-year life for machinery:										
Net cash farm income[1]	43,693	54,351	65,715	76,848	89,464	94,767	96,875	98,541	96,453	94,943
Machinery depreciation	51,172	46,446	50,307	50,091	47,794	68,602	62,954	60,851	54,038	47,129
Income tax liability	0	0	546	2,139	5,907	1,848	3,002	5,012	5,387	8,849
Machinery purchased	202,167	23,398	28,559	62,170	56,367	325,591	37,684	45,994	100,125	90,780
Percent										
Leverage ratio	49	42	36	30	23	17	15	15	14	13
Dollars										
New tax law and 7-year life for machinery:										
Net cash farm income[1]	43,639	55,589	67,722	78,714	90,625	92,551	94,166	97,973	96,562	94,666
Machinery depreciation	34,833	38,264	46,974	49,072	50,693	48,473	44,022	53,855	66,228	78,048
Income tax liability	0	727	1,143	2,489	5,972	7,165	8,873	3,642	2,245	1,243
Machinery purchased	72,000	74,709	75,327	28,313	34,557	75,226	68,205	140,299	145,586	146,790
Percent										
Leverage ratio	55	41	34	29	26	22	17	16	14	13

[1] Cash farm income declines in the later years due to production costs increasing 10 percent per year while crop prices increase only 7 percent per year.

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nancing East-central Illinois Farmers Who Hedge

Kim S. Harris and C. B. Baker*

Abstract

Survey responses of lenders in east-central Illinois suggest that lender policy toward financing initial and maintenance margin funding may discourage a farmer who needs margin fund financing in order to hedge. The wide range of policy preferences reported by lenders regarding hedge financing seems to signal that potential crop hedgers seeking hedge financing would do well to search for the lender with the hedging policies that best suit their particular needs. Certain differences in responses by type of lender (banks versus Production Credit Associations) are statistically significant.

Keywords: Farmers hedging; Credit; Margin funding; Futures market; Survey

roduction

ging is a marketing tool that enables commodity pro-
ers to protect themselves from price fluctuations by shift-
the risk of fluctuating prices to speculators.[1] Although
ires trading involves no direct transfer of funds to the
ger from the speculator or vice versa (margin deposits
ain with the broker or exchange), futures trading does
an important role in financing.

notion in industry and academia that hedging enhances
gricultural firm's ability to borrow money, specifically
ncreasing credit, is often referred to as the financing role
he futures market. Heifner (*5*) discusses the financing
of the futures market by examining the link between the
ires market and financial markets.[2] He distinguishes the
-bearing services of capital from other services. He divides
rm's capital into two categories, that used to acquire the
nt and inputs (purchasing power) and that set aside as a
erve against unforeseen losses (risk-bearing). These two
egories are not necessarily mutually exclusive.

fner develops the argument that the commodity futures
rket, in complementary with financial markets, provides a mechanism for assembling capital services and making them available to farmers. The futures market provides for transferring risk-bearing services whereas financial markets provide primarily for transferring purchasing power.[3]

Economic theory suggests that hedging reduces a borrower's price risk. Heifner suggests that the use of hedging by farm firms (borrowers) also benefits the lender either by reducing the probability of loan default or by expanding a loan without increasing the probability of default. If hedging reduces both borrowers' and lenders' risk, then hedging should increase a farmer's capacity to borrow (that is, credit).

A literature survey reveals little use of hedging by farmers (*6*) and perhaps even less encouragement by their lenders (*3*, *4*, *8*, *10*).[4] Surveys by van Blokland in Illinois and seven western States and by Duke in the southeast found no evidence to support the hypothesis that loan limits depend on a hedging program (*10*, *3*). A survey conducted by Powers found that a significant percentage of those responding banks and Production Credit Associations (PCAs) in South Dakota, Nebraska, Minnesota, and Iowa who made loans to hedged or forward contracted producers, did significantly increase the size of loan granted when by the borrower's commodities position was hedged or forward contracted (*8*).

This article summarizes and evaluates responses from a mail survey of farm lenders in a 26-county area of east-central Illinois. In an earlier article drawing from the same mail survey, evidence suggested more credit was available to crop

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nois.

[1] Hedging is defined as entering a futures position opposite
a cash position for the purpose of reducing overall expo--
e to price uncertainty. Although this article only considers
rt hedging, long hedging is also part of hedging.

[2] Italicized numbers in parentheses refer to items in the
ferences at the end of this article.

[3] By providing credit, which the farmer can reserve, the lender provides risk-bearing services as well.

[4] Berck has shown empirically that California cotton farmers' cost of hedging at planting time is high enough to discourage a producer subject to yield risk from hedging (*2*). He found that storers of cotton who have no yield risk find hedging worthwhile (p. 473).

farmers who hedged than for those who did not (*4*). However, the incremental increase was likely to be no more than the commitment required to finance margin maintenance. This article discusses factors associated with financial markets which may or may not discourage a farmer from hedging, factors relevant to financing hedging transactions, and future research needs.

Financing the Hedging Transaction

Hedging transactions incur costs that include commissions and interest paid or foregone on funds required for initial and maintenance margins. These costs must be met and considered when evaluating the profit or loss from hedging. Both the borrower and lender need to determine what these costs will be, who will finance them, and how they will be financed.

Margin

Brokerage firms require that a margin deposit be placed by the trader with the brokerage firm for each futures contract traded. The purpose of the margin requirement is to guarantee contract performance. Margins are usually larger than the maximum amount a trader can lose in 1 day from a limit move in the price.

There are two types of margins: initial (original) and maintenance. Exchanges set the size of the margin, and they can change the size of the margin without prior notice although this is done infrequently. Margins are a function of the price volatility of the commodity.

Initial Margin. The initial margin is the amount of money deposited with the broker in order for the trader to trade futures. It is a guarantee that the trader will fulfill the contract terms. For hedgers, the initial margin deposit is generally 5 to 7 percent of the total value of the contract being traded. For example, the initial margin would be $900 for one corn futures contract (5,000 bushels) with corn priced at $3 per bushel (value of one contract = $15,000), and an initial margin deposit rate of 6 percent.

Maintenance Margin. A maintenance margin is the amount that must be maintained in the trader's margin account after adjustments for price changes in the contracts held. If the price of the futures contract moves against the hedger's futures position, thus generating losses in the hedger's futures account below the maintenance level, the broker will issue a call for the amount of money needed to restore the account to the initial margin value. The broker's request for additional funds is a margin call. On the other hand, when the price of the futures contract moves in favor of a hedger's futures position, surplus money over the initial margin requirement may accumulate in the hedger's account. In such an event, the broker is legally obligated to pay any surplus over the initial margin requirement at the end of each trading day. Depending on the agreement between the hedger and the lender, this surplus may be committed to the lender thereby reducing the hedger's debt obligations.

Continuing the previous example and assuming that maintenance level requirements equal 75 percent of initial margin deposit requirements ($675), a rise in the futures price of 50 cents per bushel would result in a $2,500 margin call on every corn futures contract held by a hedger who has sold futures. Carrying the illustration one step further, if this hedger (producer) expected 128-bushel-per-acre corn yields, planted 560 acres of corn, and had hedged 70 percent of the anticipated corn crop (10 corn futures contracts = 50,000 bushels), this 50-cent-per-bushel futures price increase would result in a total margin call of $25,000 on all 10 futures contracts held. At an annual rate of 16 percent, interest costs amount to $0.438 per day for each $1,000 borrowed to cover margin calls.

Margin Calls

Margin calls can require large amounts of cash, therefore placing unexpected demands for this cash on the lender. Such calls could possibly push loan demand beyond a bank's legal lending limits. It has been suggested by Beermann (*1*) that both initial and maintenance margins be loaned to qualified borrowers (Kenyon (*7*) and Heifner (*5*) agree). Beermann reasons that both types of margins can be safely loaned because they represent a kind of cash flow. Quoting Beermann, "the loan will be repaid by either the futures price retreating to earlier levels whereby cash will be credited back to the borrowers account. Or if the futures price does not retreat, the cash price received for the hedged collateral will provide the necessary cash flow input." Beermann is ignoring interest on margin funds.

For example, if the futures price increased sufficiently, a short hedger's broker would require additional margin.[5] Such an increase in the futures price would normally be accompanied by a corresponding increase in the value of the hedger's cash position. Hence the net value of the hedger's assets (including the growing or stored crop) and obligation (including the "short" commodity futures contract) remains unchanged. Since the customer's total price risk is lowered and net asset position is unchanged, it often is argued that e lender's risk also is lessened (*1*, *5*, *7*). Thus, the lender n safely supply any funds needed for margin management.

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[5] For simplicity, we also ignore interest on margin funds and we assume no basis change. Although basis almost alway changes (there is hardly ever an equal and opposite movement between cash and futures), ignoring basis change does not affect our general conclusion that the lender can safely supply any funds needed for margin management.

owever, the argument ignores the application of lending iteria. Safety margins are imposed upon the lenders by gulatory and policy constraints. For each dollar added to e loan there must be an offsetting expectation of more an a dollar in either or both of income or equity. The loan ntract denies the lender much participation in the cusmer's upside risk, since it is satisfied by repayment of incipal and interest. However, it does not deny the lender's rticipation in the customer's downside risk, should the istomer come up short on loan repayment.

ne rewards from lending severely restrict the commercial nder in assuming perceptible risk in lending. The fact that edging can reduce price risk has only limited relevance to e lender's loan decision. On the other hand, committing line of credit that can be drawn upon to finance margin anagement may well stretch the lender's safety margins mply because of the sheer size of the potential loan.

ne economic appeal of hedging for the farmer increases ith commodity price variability and with increases in the rmer's financial vulnerability. But for the lender, the nancially vulnerable customer is one whose credit already largely exhausted, and increased price volatility increases ne size of credit commitment required for margin managelent. Hence over a given population of farmers, the demand or credit to finance hedging is likely to rise at the same time at the credit supply tightens.

ommission Costs

lthough the brokerage commission is a real cost to the edger, it is relatively small. Beermann believes lenders nould finance commission charges. He reasons that if the nder is going to finance margin calls, the additional funds eeded to finance commission charges are insignificant and y financing both costs, the creditor simplifies the accountng procedure.

inancing Alternatives

here are basically three types of loan arrangements curently practiced by lending institutions (*9*). One method is to et up a special account category for hedging. Another is a hird-party agreement between broker, lender, and customer. A third financing alternative is some form of loan agreement.

he loan agreement alternative is the most common means of inancing a hedge program. Under this arrangement various ttachments to the loan agreement designate particulars other than the normal security agreement. For example, a specific attachment might stipulate that only 75 percent of what the borrower and lender agree as the crop size will be hedged before harvest. Such an attachment might go even further and stipulate certain dates when so much crop must be hedged.

The other two financing alternatives are less common. In setting up a special account category for hedging, the customer and the lender establish a realistic amount of funds to cover hedging margin calls. There are several variations on this theme. In some cases, margin funds are transferred directly from the lender to the brokerage house. The amount and timing of transferrals are based on decisions made by the producer. In other cases, the margin funds are transferred first to the farmer and then to the broker.

Another hedge financing option is where the broker, lender, and customer enter into a legally binding three-party agreement. In this situation, the broker cannot execute an order without getting prior approval from the banker. All concerned parties are fully aware of the objectives of the hedging program and know one another's role in the program. An agreement of this nature might be used in a high-risk situation.

Methodology

The data used in this investigation were generated from a mail-out questionnaire designed to measure a lender's credit responses and attitudes toward hedging by farmer customers.

Questionnaires were mailed October 19, 1979, to 328 credit agencies in Illinois, including 303 commercial banks and 25 field and central PCA offices. Banks and PCAs constitute the major institutional sources of nonreal estate agricultural loans. The credit agencies surveyed are located in a 26-county area in east-central Illinois designated by the U.S. Department of Agriculture's Economic Research Service (ERS) as predominantly grain producing.

Banks were selected from the 1979 *Illinois Bank Directory*. PCAs were selected from a list of PCA central and field offices provided by Production Credit Association Services of Illinois. The entire population of banks and PCAs in the 26-county area was surveyed.

In the month allowed for responses, 159 questionnaires were returned, a 48.5-percent response rate. Of those returned, 145 (44.2 percent of the number sampled) were suitable for analysis.[6] The questionnaires focused on preharvest hedged grain pledged as collateral for nonreal estate loans to farmers, and specifically, on corn and soybeans.

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[6] Of the 14 questionnaires not analyzed, 13 indicated that the lending institution had no farm customers, and one was determined not suitable for analysis.

Results

Results reported here apply to only 77 of the suitable 145 respondents (53.1 percent). These 77 respondents (67 banks and 10 PCAs) indicated they had loaned to farmers who pledged preharvest hedged corn and/or soybeans as collateral (*4*). The other 68 respondents indicated they had never loaned to hedged farmers. Most of the 77 respondents who had loaned to hedgers indicated they had done so largely on the basis of perceptions that hedging reduces the risk of both borrower and lender. They indicated they follow a variety of policies when administering and financing hedges.

The 77 respondents who loaned to hedgers were asked about their credit agency's policy when financing initial and maintenance margin funds. Respondents were instructed to circle the most appropriate choice(s). Forty-three responded (table 1). Thirty-two of the 43 respondents indicated their agency policy is to provide financing for both the initial and maintenance margin funds rather than to provide for one or the other or a percentage of both. Where possible, characteristics of the 34 nonresponders were checked with characteristics of the 43 responders. No significant difference was found in characteristics of the two groups.

The likelihood that a credit agency finances both initial and maintenance margins does not differ significantly among bank sizes but is significantly larger for PCAs than banks (table 2).

Table 1—Lenders' policy in providing funds for initial and maintenance margins

Policy	Number of responses	Percent of total
Provide money for:		
Initial margin only	3	7.0
Maintenance margin only	4	9.3
Both initial and maintenance margins	32	74.4
A percentage of both	4	9.3
Total[1]	43	100.0

[1] Based on responses from 43 out of 77 potential respondents. The 34 nonrespondents who loaned to hedgers but did not provide information about their policy in financing hedging costs did not differ in any systematic way from the 43 respondents who did provide information.

Table 2—Probability that credit institution finances initial maintenance margins, by size and type of credit agency[1,2]

Agency size and type	Probability of financing initial and maintenance margins
	Percent
Small banks[3]	21.4
Medium banks[4]	52.6
Large banks[5]	35.7
All banks	34.4
PCAs	80.0

[1] For a discussion of size stratification among banks see (*4*, p. 48).

[2] Differences not significant at .05 probability level among bank sizes (raw chi square value = 4.89523; degrees of freedom = 2). Differences are significant at .05 probability level between all banks and PCAs (raw chi square value = 7.38535; degrees of freedom = 1).

[3] Assets valued at less than $20 million.

[4] Value of assets between $20 and $50 million.

[5] Assets valued at more than $50 million.

Several other questions about administering and financing hedges were asked of the 77 lenders who have loaned to hedgers. Those lenders were asked about their agency's policy when financing margin calls. They were instructed to circle all appropriate response choices. Seventy-one of the 77 potential respondents answered the question, providing the 81 responses summarized in table 3. A majority of the 71 respondents indicated money provided for hedge financing is part of the customer's operating and/or inventory line of credit. The likelihood that money for margin financing is provided from the line of credit to finance inventory and/or operating expenses does not differ significantly among bank sizes but is significantly higher for banks than PCAs (table 4).

When asked what kind of advice they give to customers on hedging, 73 of 77 potential respondents answered. They provided the 89 responses arrayed in table 5. None of the banks or PCAs required hedging. Nor did any of the credit agencies that had loaned to farmers forbid hedging.

Finally, lenders were asked whom they prefer to manage a customer's hedged account. Fifty-eight of a potential 77 respondents replied. Data in table 6 indicate that a majority of the 58 respondents preferred customers to manage their own accounts. Sixteen of the 58 respondents indicated a preference for third-party agreements between broker, lender, and customer which are legally binding on all parties. The likelihood that a credit agency prefers a third-party agreement between lender, broker, and borrower does not differ significantly among banks but does differ significantly between all banks and PCAs (table 7).

able 3—Credit agency policy when financing margin calls

Agency policy	Number of responses	Percent of total
ney provided for hedge from line of credit to finance inventory and/or operating expenses	42	51.9
up special account category for advancing margin call money	15	18.5
rgin excess in customer's brokerage account applied to payment of customer's note	24	29.6
Total[1]	81	100.0

[1] Based on responses from 71 out of 77 potential respondents.

onclusions

ere were 34 respondents who did not answer the survey estion that asked what their credit agency policy was when ancing initial and maintenance margin funds (see table 1). is difficult to interpret their nonresponse. No significant fference was found in characteristics between responders d nonresponders. If we assume the 34 nonresponders do t provide any degree of funding for margin maintenance, en the incidence of lenders providing money for both the itial and maintenance margins rather than providing money for one or the other or a percentage of both is surprisingly low. One would expect the lender willing to finance a hedged inventory would also be willing to finance the margin maintenance requirements. Not to do so invites either split financing on the part of the borrower or the risk that the borrower, for lack of finance, may be forced by margin calls to stop hedging. One plausible explanation for this apparent contradiction on the part of the lender is the probability of a less than complete understanding of the hedging process by certain lending officers.[7] If this is the case, lenders may be (through lending policy) inadvertently discouraging farm clients from hedging. Consequently, producers and their creditors may be foregoing some significant opportunities to obtain preferred combinations of risks and expected profits through hedging.

Another credible scenario is that most lenders do understand the benefits to be gained through hedging for borrower and lender alike as indicated by certain survey responses (*4*).

Table 4—Probability that money provided for margin financing is a part of operating line of credit, by size and type of credit agency[1,2]

Agency size and type	Probability margin funding a part of operating credit line
	Percent
mall banks[3]	67.9
ledium banks[4]	52.6
arge banks[5]	71.4
ll banks	63.9
CAs	30.0

[1] For a discussion of size stratification among banks see (*4*, p. 48).

[2] Differences not significant at .05 probability level among bank zes (raw chi square value = 1.58054; degrees of freedom = 2). Dif- erences are significant at .05 probability level between all banks and CAs (raw chi square value = 4.09470; degrees of freedom = 1).

[3] Assets valued at less than $20 million.

[4] Assets valued between $20 and $50 million.

[5] Assets valued at more than $50 million.

Table 5—Credit agency policy toward promotion of customer hedging

Policy	Number of responses	Percent of total
Discourage strongly	0	0
Allow, but do not actively promote	39	43.8
Provide general advisory service	17	19.1
Encourage selective hedging	33	37.1
Insist on hedging	0	0
Total[1]	89	100.0

[1] Based on responses from 73 out of 77 potential respondents.

Table 6—Lender preferences for management of customer's hedged account

Preferred manager of customer's hedged account	Number of respondents	Percent of total
Lender	2	3.5
Customer	36	62.1
Broker	4	6.9
Third-party agreement	16	27.5
Total[1]	58	100.0

[1] Based on responses from 58 out of 77 potential respondents.

Lenders' low response rate to a willingness to provide money for both the initial and maintenance margins may merely reflect their perception that a meteoric adverse futures price movement might push the margin loan above the credit institution's legal or self-imposed lending limit. Survey results indicate that PCAs are significantly more likely than banks to finance both initial and maintenance margins, possibly because banks are constrained by legal lending limits while PCAs are not. Banks constrained by legal lending limits might anticipate overline loan requirements early in order to prepare an overline request for a commitment from a city correspondent bank.

Another plausible reason why farmers may not be hedging is that the majority of farmers do not understand hedging. Underlying this possibility is an alternative marketing mechanism to hedging: forward cash contracting. Lenders and borrowers may make greater use of forward cash contracting with an elevator because they find it a simpler and more easily understood process than hedging. Certain lenders in written comments attached to the survey indicated this possibility. Several lenders commented about the increased overhead necessary to manage hedged accounts (included in this hedge overhead was the need to follow futures and spot markets closely). They also commented on the difficulty some lenders and borrowers have in understanding hedging mechanics. For these reasons these creditors indicated a preference for other marketing alternatives such as forward cash contracting.

In addition to their policy toward financing margins, the 77 respondents who have loaned to hedgers indicated a variety of other policies they follow when administering and financing hedges. None of the responding banks or PCAs require or forbid hedging. Lenders' responses indicated that they prefer to leave the initiative of whether to hedge or not with the customer. Lenders also preferred customers to manage their own hedged accounts instead of the lender, the broker, or a third-party management agreement between lender, broker, and customer. Furthermore, lenders indicated a preference for hedge financing to be a part of the customer's operating and/or inventory line of credit.

Survey responses indicate that, as a group, a significantly greater proportion of PCAs prefer legally binding third-party agreements than do banks. Furthermore, data analysis reveals that a significantly smaller proportion of PCAs prefer providing margin money from inventory and/or operating lines of credit than does the bank group. These two observations may be explained in a similar manner. It may be possible that, due to the nature of the Farm Credit System relative to banking operations, PCA loan officers have less knowledge of the personal characteristics (such as integrity, etc.) of their client. If this is true, then perhaps PCAs use lending policies that minimize this uncertainty such as preferring third-party agreements and establishing special hedge loan accounts that can be closely monitored.

The wide range of policy preferences indicated by survey responses seems to signal that a potential crop hedger seeking financing would do well to search for the credit agency with the hedging policies that best suit the hedger's particular needs.

Further Research Needs

Uncertain conclusions based on conflicting evidence drawn from the study suggest the need for a more intensive survey of those who finance hedges. We strongly suggest using a projective technique in personal interviews. Conclusions drawn from our survey can only be applied to the population of lenders in the 26-county area of east-central Illinois. Illinois is one of the most restrictive States in terms of bank regulations. Consequently, our results are area specific. A survey sample of a larger population of lenders (State, region, Nation) could aid comparative studies. It would also be valuable to research lenders' preferences for their customers to use forward cash contracts for expected production instead of hedging, and to survey farmers to determine the factors that discourage and encourage their use of hedging as a marketing and financing tool.

Table 7—Probability that credit agency prefers third-party agreement between lender, broker, and borrowers, by credit agency size and type[1,2]

Agency size and type	Probability of preference for third-party agreement
	Percent
Small banks[3]	17.2
Medium banks[4]	15.0
Large banks[5]	21.4
All banks	17.5
PCAs	50.0

[1] For a discussion of size stratification among banks see (*4*, p. 48).

[2] Differences not significant at .05 probability level among bank sizes (raw chi square value = .23794; degrees of freedom = 2). Differences are significant at .05 probability level between all banks and PCAs (raw chi square value = 5.33943; degrees of freedom = 1).

[3] Assets valued at less than $20 million.

[4] Assets valued between $20 and $50 million.

[5] Assets valued at more than $50 million.

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[7] Several studies have concluded that more commodity industry and academic resources need to be allocated to educational efforts aimed at increasing lenders' understanding of hedging (*3*, *6*, *10*).

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Investment in Agriculture: An Empirical Analysis

By R. McFall Lamm, Jr.*

Abstract

This paper applies generally accepted macroeconomic investment theories to explain aggregate agricultural investment behavior. Empirical results indicate that changes in agricultural output, farm-level prices, and the cost of capital have statistically significant effects on real farm investment. A Bischoff-type investment function is found to fit the data best. The findings show specifically that a 1-percent increase in output or farm prices causes a $.11-billion to $.24-billion increase in real agricultural investment, while increases in the cost of capital have a substantial negative effect on investment. Implications are that investment will likely be more unstable in the future.

Keywords: Investment, farm sector, cost of capital

Most recent economic studies of agricultural investment focus on capital expenditures by individual farmers or farm-related enterprises. As a consequence, the traditional macroeconomic view of investment as the sum of capital outlays on all productive inputs has been largely neglected in studies of agricultural investment.[1] This paper examines the determinants of agricultural investment by applying generally accepted macroeconomic investment theories to explain investment behavior in the farm sector.

Increased agricultural investment expands food and fiber production capacity, it adds to Gross National Product (GNP), and it induces productivity growth since new capital tends to be more efficient in its use of inputs. Further, increased agricultural investment ultimately stimulates the competitive efficiency of domestic agriculture in world markets as prices are pushed down from investment-induced technology change. This improves the trade balance, *ceterus paribus*. In addition, agricultural investment serves as a measure of the current health of the farm sector and as an indicator of future farm output. Thus, it is important to understand the basic determinants of domestic agricultural investment if the implications of change in the farm sector, or changes in farm sector policies, are to be fully understood.

Recent Investment Trends

Gross private domestic agricultural investment is the sum of the following components of the national investment accounts: nonresidential investment in farm structures and farm durable equipment; residential investment in farm structures; and change in farm business inventories. In recent years, nonresidential investment in producers' durable equipment has accounted for about 67 percent of farm gross private domestic investment. This is up from less than 60 percent of agricultural investment in the fifties (table 1), reflecting continued substitution of capital for labor in the agricultural sector. Nonresidential investment in structures as a percent of total farm gross private investment has risen—

Table 1—Components of farm gross private domestic investment

Period	Nonresidential fixed investment		Residential structures	Change in inventories
	Structures	Producers'[1] durable equipment		
	Percent of total			
1950-59	17.3 (3.6)	59.2 (8.2)	16.2 (2.9)	7.4 (13.6)
1960-69	18.9 (1.9)	63.8 (7.1)	11.9 (2.2)	5.4 (8.7)
1970-79	19.3 (3.4)	66.5 (10.2)	8.6 (2.0)	5.6 (11.6)
1946-79 (postwar)	19.8 (6.7)	64.2 (14.0)	13.8 (7.0)	2.2 (24.2)

Note: Standard deviations are presented in parentheses.
Source: Derived from Bureau of Economic Analysis (BEA) dat on national investment.

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*The author is an economist, formerly with USDA's Economic Research Service (ERS). Anne Rogers provided research assistance.

[1] A substantial amount of work was done in this area in the sixties, characterized importantly by Heady and Tweeten's study of the structure of agriculture.

m about 17 percent of total agricultural investment in the
ies, to more than 19 percent in the seventies. However,
share of investment in residential structures has declined—
m more than 16 percent in the fifties to less than 9 per-
t in the seventies. The change in the inventory share of
m investment declined from the fifties to the sixties, but
nained stable in the seventies.[2]

ricultural investment has declined relative to total gross
vate investment in the United States. In the fifties, farm
tor investment accounted for about 10 percent of total
mestic investment, but fell to only 5 percent by the end of
seventies. Thus, even though real agricultural investment
s been rising, nonfarm investment has been rising faster.
is is predominantly a consequence of greater output in-
eases in the nonfarm sector (requiring relatively more
vestment) and faster productivity growth in agriculture
quiring relatively less investment).

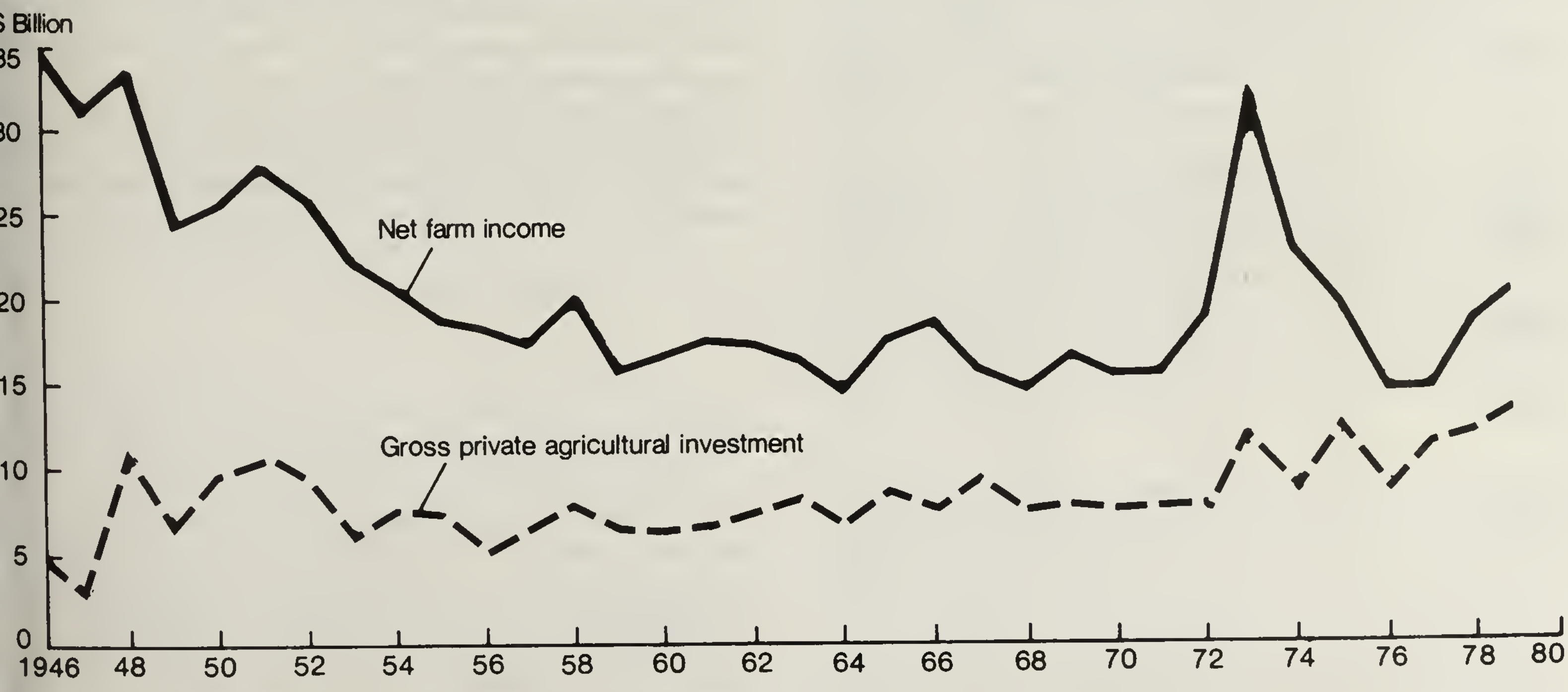
though real agricultural investment has trended upward
the postwar period, there was a noticeable investment
rge in the seventies (fig. 1 and table 2). Real farm invest-
ent (deflated by the GNP implicit price deflator) averaged
out $7.5 billion in 1972 dollars throughout the fifties and
sixties, but increased to $9.9 billion per year in the seventies. Farm investment actually trended downward in the fifties (4.3 percent per year), but trended upward in the sixties (2.6 percent). Through the seventies, farm investment rose approximately 5.0 percent per year—an acceleration in growth of farm gross investment and a turnaround from the declines of the fifties and slow growth in the sixties.

Figure 1 also compares real net farm income (based on an ERS series) with real farm investment over the postwar era. Indications are that farm investment generally trended up while farm income trended down. Real investment rose 1.6 percent per year from 1946 through 1979. But real net farm income declined from an annual average of more than $20 billion in the fifties to $16.4 billion in the sixties, then rose somewhat in the seventies to an average of more than $18 billion per year. This represented an average decline in real net farm income of 1.5 percent per year, however.

The seemingly paradoxical decline in real net farm income and the increase in real agricultural investment over the postwar period is difficult to explain. In the nonfarm sector, when both real income and investment increase steadily, a positive relationship between income and investment would be expected. But this pattern apparently does not hold in the agricultural sector. One explanation may simply be definitional—net farm income excludes the capitalized value of higher land prices. Much of the real return to farming over the last 20 years has been from appreciating land values. Capital gains from land holdings could be used to finance

igure 1

let Farm Income and Gross Private Agricultural Investment



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[2] Note that net additions or subtractions to the land base
disregarded since transactions that simply transfer owner-
ip of existing assets are not reflected in the national invest-
ent accounts.

farm investment. Thus, a different measure of farm welfare might alter the situation depicted in figure 1 and might give a postive relationship between income flow and investment. But it is questionable whether adding land appreciation would show real increases in income flows. In addition, other factors besides income influence agricultural investment. Once the appropriate allowances for other variables are made, the empirical relationship between farm income and investment may in fact be positive. For this reason, it is necessary to turn to some of the general theories offered regarding the relationship between investment, income, output, and other variables.

Investment Models

Four basic macroeconomic models have been offered to explain investment behavior.[3] These include: the generalized accelerator model (*4*), the accelerator cash-flow model (*3*), the basic neoclassical model (*10*), and the modified neoclassical model (*1*).[4] Each is essentially macroeconomic in orientation and application, but all have plausible microeconomic foundations.

The generalized accelerator model is based on the premise that desired capital stock is related (usually linearly) to output (Y). Consequently, because net investment (I^N) is the change in capital stock between any two periods, it is simply a linear function of income change when both desired and actual capital stock are equal. But desired and actual capital stock are unlikely to ever correspond exactly, and a reasonable assumption is that actual capital stock responds after delay to changes in output. For this reason, distributed lags on output change are normally included in the general accelerator model to explain delayed reaction. Hence,

$$I^N{}_t = B(L)\Delta Y_t \tag{1}$$

$$t = 1, \ldots, T$$

where B(L) is the polynomial lag operator on output change. To obtain an estimable equation (since I^N is not observable) it is normally assumed that depreciation is exponential and a function of $B(L)\Delta Y_t$. This allows gross investment (I) to be written as

$$I_t = B(L)\Delta Y_t + dK_{t-1} \tag{2}$$

$$t = 1, \ldots, T$$

where K is capital stock and d is a parameter representing the rate at which capital stock depreciates. This is the basic form of the generalized accelerator model.

Table 2—Real farm gross private domestic investment and net farm income, levels and average annual changes

Period	Investment		Income	
	Level	Change	Level	Change
	Billion dollars[1]	*Percent*	*Billion dollars*[1]	*Percent*
1950-59	7.5 (1.3)	–4.3 (1.9)	20.7 (1.2)	–5.7 (.9)
1960-69	7.5 (1.2)	2.6 (1.2)	16.4 (1.1)	–.7 (.8)
1970-79	9.9 (1.2)	5.0 (1.7)	18.4 (1.3)	–.2 (2.9)
1946-79 (Postwar)	7.9 (1.3)	1.6 (.4)	19.5 (6.1)	–1.5 (.4)

[1] 1972 dollars.

Note: Standard deviations are presented in parentheses.
Source: Investment derived from BEA data; net farm income is from ERS.

The accelerator cash-flow model is identical to the generalized accelerator model except that either profits or a cash-flow variable is added as a determinant of investment. The rationale for adding a profits or cash-flow variable is simply that greater current profitability produces expectations of increased future profitability. This stimulates current investment. Another argument for the inclusion of profits or a cash-flow variable is that higher current profits stimulate investment since it is easier to finance expansion with internal funds. Under the assumption of delay before increased cash flow influences investment, the accelerator cash-flow model is

$$I_t = B(L)\Delta Y_t + C(L)F_t + dK_{t-1} \tag{3}$$

$$t = 1, \ldots, T$$

where C(L) is a polynomial lag operator on cash flow F.

Basic neoclassical theory maintains that factor utilization depends on its price. The generalized accelerator and the accelerator cash-flow models omit a variable to measure the price of capital. The neoclassical model attempts to remedy this deficiency. Under the assumption of competition and a Cobb-Douglas production function, desired capital (K^D) can be determined directly from the first-order profit maximizing dition requiring the value of capital's marginal product qual its price. The result is

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[3] This section draws heavily on Clark (see References).

[4] Italicized numbers in parentheses refer to items in the References at the end of this article.

$$K^D = gpY/c \qquad (4)$$

ere g is capital output elasticity, p is product price, and c he price of capital—the user cost of capital.[5] Using

$$I^N_t = I_t - dK_{t-1} = K^D_t - K^D_{t-1}$$

the further assumption that actual capital use is a de- ed function of desired capital use, the basic neoclassical del becomes

$$I_t = G(L)\Delta x_t + dK_{t-1} \qquad (5)$$

$$t = 1, \ldots, T$$

ere G(L) is a polynomial lag operator and $x_t = (p_tY_t/c_t)$.

widely accepted variant of the neoclassical model has been oposed by Bischoff. In his modified neoclassical model, estment is assumed to respond to changes in factor price ly after delay, while changes in desired capital stock, and nce investment, respond to current changes in income. is leads to two distributed lag structures and an investment uation of the form

$$I_t = J(L)z_t + R(L)v_t + dK_{t-1} \qquad (6)$$

$$t = 1, \ldots, T$$

ere J(L) and R(L) are polynomial lag operators, $= p_{t-1}Y_t/c_{t-1}$, and $v_t = p_{t-1}Y_{t-1}/c_{t-1}$.

stimation Results

ble 3 presents the results of estimating the models de- ribed in the previous section as well as estimates of a third- der autoregressive investment model.[6] In brief, I is real oss agricultural investment (from BEA), Y is defined as ricultural output (the farm production index, 1967=100, om ERS), K is capital stock (the value of farm assets in billion dollars, from the ERS farm balance sheet), and F is cash flow (net cash farm income in billion dollars from BEA). In addition, p is the index of prices received by farmers (from USDA's Statistical Reporting Service) and c is defined as the average rate on loans made by Production Credit Associations (from USDA's Farm Credit Administration)—included as an instrument for the user cost of capital.[7] All monetary variables are deflated by the prices received by farmers index, while lengths of distributed lags are determined by deleting explanatory variables not statistically significant (with 90-percent confidence) in an initial regression with 1- to 3-year lags.

Clearly, the Bischoff model with a 1-year lag on z_t and v_t fits the data better than any of the other models. It explains 92 percent of the variation in real agricultural investment over the postwar period, and the estimated coefficients on z_t, v_t, and depreciation are all highly significant statistically.[8] The estimates imply that a 1-unit increase in agricultural production (slightly less than 1 percent at the mean sample level) leads to an immediate $.69-billion increase in real agricultural investment, a $1.29-billion decline in real investment 1 year later, and a $.71-billion increase 2 years later. This gives a total multiplier of $.11 billion. Unit increases in the prices received index have similar positive effects. But increases in capital costs have a net negative impact on investment—a 1-percent increase in capital price leads to an immediate $.69-billion decline in investment in the current year, a $1.29-billion increase in the succeeding year (presumably as a consequence of delayed purchases), and a $.71-billion decline 2 years later. Thus, a 1-percent increase in the price of capital is seen to ultimately reduce real investment $.11 billion. In addition, a $1-billion increase in real capital stock induces $.014 billion in investment 1 year later to replace depreciated capital. As theory clearly predicts, increases in output, prices, and capital stock have a substantial positive influence on investment, while increases in capital costs have a negative impact on investment.

The reported form of the Bischoff model in table 3 contrasts somewhat with that for standard macroeconomic investment equations. In particular, virtually all macroeconomic empirical studies of the Bischoff model yield a large current multiplier for the impact of output on investment. But because much of actual farm output is produced in the fourth quarter of the year following harvest, and because most agricultural investment is made in the first quarter of the next year preceding planting, the finding of rather substantial lagged impacts seems reasonable. In particular, the finding that a large increase in output this year (which is usually associated with low prices and declines in farm cash income) causes a reduction in real investment next year is exactly what would be expected. In years of large harvests, many farmers experience losses and either sell-out or substantially reduce production in the following year.

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[5] This is the imputed rent for one unit of capital goods ed over 1 year. It consists of three components: (1) the terest cost of the capital good—the opportunity cost curred by tying up funds—usually measured by the interest te times the price of the good; (2) the amount the good epreciates in each period; and (3) capital gains or losses sociated with changes in the market price of the good ften omitted from user cost).

[6] The "naive" autoregressive model is included as a stanrd for comparison. The influence of special farm policies agricultural investment are assumed to be reflected in the dependent variables. The sample period included in estimaon covers the years 1946-79.

[7] This is an arbitrary choice, of course. It presumes constant depreciation and disregards capital gains, but should be an approximate indicator of the unit cost of agricultural capital used over 1 year.

[8] Both Granger and Sims causality tests were conducted prior to estimation to determine whether investment causes income or vice versa. In all trial regressions, farm output was found to cause agricultural investment, but in no instance was agricultural investment found to cause farm output.

Regarding the other models considered in the study, both the general accelerator and the accelerator cash-flow models are found to fit the data fairly well, but give less plausible results than the Bischoff model. The general accelerator model indicates that a one-unit increase in output causes a $.118-billion rise in investment in the current year and a $.097-billion decline in the following year. Hence, the total impact of a unit output increase is $.021 billion. This seems small, intuitively. The accelerator cash-flow model also gives somewhat questionable results. A one-unit increase in output causes real investment to rise $.15 billion in the current year, while a $1-billion increase in cash flow induces a $.024-billion decline in investment in the current year and a $.025-billion increase the next year—a total impact of $.001 billion. This seems small, but suggests that cash availability is an important determinant of investment.

The use of the farm production index as the agricultural sector output variable is consistent with the standard macroeconomic definition of output as the real value of final sales of goods and services within the sector. And similarly, the use of net cash income to measure farm cash-flow is consistent with the standard macroeconomic usage, except that taxes are not subtracted out (nominal cash-flow is typically defined as the sum of after-tax profits, capital consumption allowances, and inventory valuation adjustment). Other alternative income and cash-flow variables do exist, however.

One candidate to replace farm output is real gross farm income defined as actual gross income (from ERS) deflated by the prices received index. This measure differs from the production index by including inventory changes, government payments, other farm cash income (from sources other than livestock and crop sales), and nonmoney farm income. It may more closely approximate the value of goods and services produced in the agricultural sector and reflects a broader definition of output. In addition, an alternative measure of well-being that might be more appropriate than net cash income is net farm income (from ERS). This measure differs from net cash income in that it includes nonmoney income, the value of inventory change, net investment as an expense, and excludes the value of prerequisites to hired workers. It may be a better gauge of income flow, but its omission of taxes paid by farmers makes it less than ideal.

To explore the sensitivity of model estimates to alternative variable definitions, table 4 presents the results of estimating several versions of the accelerator cash-flow model using real

Table 3—Estimates of agricultural investment equations

Model	Estimate[1]				
General accelerator	$1.70 + .118\,\Delta Y_t - .097\,Y_{t-1} + .019\,K_{t-1}$ (.41) (.043) (.042) (.002)	$R^2 = .85$	$d = 1.25$	$r = .33$	mse = .41
Accelerator cash-flow	$1.42 + .150\,\Delta Y_t - .024\,F_t + .025\,F_{t-1} + .0200\,K_{t-1}$ (.92) (.039) (.010) (.009) (.0019)	$R^2 = .86$	$d = 1.27$	$r = .35$	mse = .40
Neoclassical	$1.84 + .153\,\Delta x_t - .070\,\Delta x_{t-1} + .178\,\Delta x_{t-2} + .0184\,K_{t-1}$ (.53) (.082) (.076) (.075) (.0026)	$R^2 = .79$	$d = 1.84$	$r = .04$	mse = .57
Bischoff	$1.31 + .69\,z_t - .72\,z_{t-1} - .57\,v_t + .71\,v_{t-1} + .0140\,K_{t-1}$ (.38) (.19) (.19) (.18) (.18) (.0018)	$R^2 = .92$	$d = 1.61$	$r = .14$	mse = .23
Autoregressive	$.34 + .22\,I_{t-1} + .67\,I_{t-2} + .10\,I_{t-3}$ (.70) (.17) (.12) (.16)	$R^2 = .73$	$d = 2.24$	$r = -.14$	mse = .72

[1] Estimated standard errors are presented in parentheses; d is the Durbin-Watson statistics; r is the estimated first-order residual autoregressive coefficient; and mse is mean square error.

gross farm income and net farm income as alternative output and cash-flow measures.[9] A version of the Bischoff model using real gross farm income is also presented. The results differ substantially from those presented in table 3.

When real gross income is used as the output measure in the accelerator cash-flow model, its coefficient is much larger than that obtained when the farm output index is used, implying a larger multiplier effect. Similarly, when net farm income is used as the cash-flow variable, the associated multipliers are found to be much larger, implying that investment is more responsive to changes in net farm income than to changes in cash income. Finally, in the Bischoff model when real gross farm income is included as the output measure, the results are similar to those presented in table 3, except that explanatory power is much lower and the estimated coefficients larger in absolute value. The total investment multiplier is .24, more than double that obtained when the farm output index is used. Importantly, however, the Bischoff model still appears best in terms of fit, but clearly all model parameters are somewhat sensitive to variable definition.

Conclusion

On the basis of fit and statistical confidence, it seems appropriate to accept the Bischoff model presented in table 3 as the best approximation to the historical relationship between agricultural investment and its principal determinants over the postwar period. At minimum, the reported estimates provide substantial evidence of the direct relationship between agricultural output, prices received by farmers, the price of capital, and agricultural investment. The reported estimates probably represent only an approximate indication of the magnitude of the relationship between these variables, however.

The finding of an agricultural sector investment multiplier of between .11 and .24 for the Bischoff model is important. Estimates of the static macroeconomic investment multiplier have traditionally centered on .15. Lamm estimated an agricultural sector investment multiplier at .15 using a different model specification and data set. Thus, the empirical

Table 4—Alternative estimates of accelerator cash flow and Bischoff models

Variables	Estimate[1]
	Accelerator cash-flow:
Y = real gross farm income F = net farm income	$\underset{(.92)}{-4.95} + \underset{(.125)}{.528}\,\Delta Y_t + \underset{(.024)}{.105}\,F_t + \underset{(.132)}{.374}\,F_{t-1} + \underset{(.002)}{.019}\,K_{t-1}$
	$R^2 = .83$, d = 1.51, r = .21, mse = .45
Y = real gross farm income F = cash farm income	$\underset{(1.24)}{1.04} + \underset{(.109)}{.201}\,\Delta Y_t - \underset{(.012)}{.025}\,F_t + \underset{(.011)}{.028}\,F_{t-1} + \underset{(.002)}{.021}\,K_{t-1}$
	$R^2 = .81$, d = 1.39, r = .26, mse = .51
Y = output F = net farm income	$\underset{(1.42)}{-.53} + \underset{(.043)}{.184}\,\Delta Y_t + \underset{(.095)}{.049}\,F_t + \underset{(.098)}{.119}\,F_{t-1} + \underset{(.002)}{.018}\,K_{t-1}$
	$R^2 = .83$, d = 1.81, r = .09, mse = .45
	Bischoff:
Y = real gross farm income	$\underset{(.39)}{1.08} + \underset{(.40)}{1.11}\,z_t - \underset{(.39)}{.75}\,z_{t-1} - \underset{(.37)}{1.10}\,v_t + \underset{(.36)}{.99}\,v_{t-1} + \underset{(.003)}{.014}\,K_{t-1}$
	$R^2 = .89$, d = 2.06, r = -.03, mse = .33

[1] Estimated standard errors are presented in parentheses; d is the Durbin-Watson statistics; r is the estimated first-order residual autogressive coefficient; and mse is mean square error.

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[9] Although both the farm production index and real gross farm income are highly related (with simple correlation coefficient equal to .93), as are net farm income and net cash income (with simple correlation coefficient equal to .95), their estimated coefficients need not be similar in alternative models of investment.

findings from this study are consistent with previous results. Also, since the mean sample investment-to-income ratio (the average propensity to invest) is .13, the estimation of an agricultural investment multiplier in the .11 to .24 range does seem realistic.

But the acceptance of the Bischoff model as the appropriate representation of net farm investment behavior has other important implications. The Bischoff model indicates that agricultural investment is as sensitive to changes in prices farmers receive and capital costs as it is to changes in output. But because these former two variables fluctuate much more than output over time, they clearly have a greater effect on changes in investment. In this regard, policies which tend to stabilize farm-level prices and interest rates would tend to have a stabilizing effect on farm investment, and vice versa.

Thus, a consequence of a return to free-market agriculture, which would presumably bring about greater price fluctuation, as well as a continuation of the current Federal Reserve policy of allowing interest rates to vary freely, will be greater variance in agricultural investment.

Additional work remains to be done. The variables used in this study do not correspond perfectly to their macroeconomic counterparts—the empirical investigation presented here points to inadequacies in the existing agricultural sector information system. Available data are not entirely consistent conceptually with the national income accounts. Clearly, there is a need for a cash-flow farm sector measure that subtracts out income taxes paid by farmers. When these data are available, a more detailed and thorough analysis of agricultural investment will be possible.

Appendix: Data Sources

Variable	Definition and Source
Gross agricultural investment (I)	Sum of (1) nonresidential investment in farm structures and durable equipment, (2) residential investment in farm structures, and (3) change in farm business inventories—in billion dollars from computer printouts provided by BEA.
Agricultural output (Y)	Index of farm output, 1967=100, from *Economic Indicators of the Farm Sector, Production and Efficiency Statistics, 1980*, ERS, U.S. Department of Agriculture, Statistical Bulletin 679, January 1982.
Capital stock (K)	Value of farm assets in billion dollars, from *Economic Indicators of the Farm Sector, Income and Balance Sheet Statistics, 1980*, ERS, U.S. Department of Agriculture, Statistical Bulletin 674, September 1981.
Cash flow (F)	Net farm cash income in billion dollars, from *1980 Supplement to Economic Indicators*, Joint Economic Committee Print, U.S. Government Printing Office, Washington, D.C., 1980.
Prices received by farmers (p)	Index of prices received by farmers, 1967=100, from *1980 Supplement to Economic Indicators* (referenced above).
Cost of capital proxy (c)	Average rate (percent) on loans made by Production Credit Associations, from selected annual issues of *Agricultural Statistics*, U.S. Department of Agriculture, Washington, D.C., annually.
Gross farm income	Gross farm income is billion dollars, from *Income and Balance Sheet Statistics, 1980* (referenced above).
Net farm income	Net farm income (after inventory adjustment) in billion dollars, from *Income and Balance Sheet Statistics, 1980* (referenced above).

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A Reduced Form Model for PCA Interest Rates

By Paul Sundell and Lloyd Teigen*

Abstract

This paper derives a simple unrestricted reduced form model for Production Credit Association interest rates, primarily for prediction purposes, that can be easily integrated into macroeconomic and agricultural econometric models. The performance of the basic model is compared with two more complicated variants of the basic model on both an in-sample and out-of-sample basis. The results indicated that although the more complicated variants performed better on an in-sample basis, the basic model had superior out-of-sample forecasts.

Keywords: Production Credit Associations; Federal Intermediate Credit Banks; Reduced form model; Structural model; Dummy variable; Varying parameter model

Introduction

Interest rates in recent years have become much more volatile due to major shifts in economic activity, fiscal policy's long-term outlook, and monetary policy's emphasis toward monetary aggregate and reserve targets. Since agricultural borrowers and lenders actively compete for funds with the nonagricultural sector, agricultural interest rates have also become more volatile, thus complicating the problem of forecasting agricultural interest expenses. Therefore, given the wide swings in interest rates and the interdependence of the agricultural and nonagricultural sectors in general, econometric models should be developed that capture this interdependence and can be easily updated to changing economic assumptions and data.

As a small part of this effort to integrate agricultural and nonagricultural models, this paper estimates an unrestricted reduced-form model for Production Credit Association (PCA) interest rates as a function of Treasury interest rates that are normally forecast in the financial sectors of macroeconomic models. In particular, the PCA model was estimated from the second quarter of 1969 to the fourth quarter of 1979. The parameter estimates were then used to predict PCA rates on an unconditional out-of-sample basis for 1980 and the first three quarters of 1981. The out-of-sample predictions were all within 50 basis points and two standard forecast errors of zero with the exception of the second and third quarters of 1980.

Among the factors not accounted for in the model that contributed to the relatively large forecast errors for the middle two quarters of 1980 was the strong loan demand at PCAs during this period. The strong loan demand at PCAs necessitated heavy debt issuance by the Federal Intermediate Credit Banks (FICBs) during near-peaks in money and capital market interest rates in the spring of 1980. Another factor not accounted for in the model's error is the general shortening of the debt structure of the FICBs in recent years. The shortening of the debt structure has reduced the time necessary for the FICBs to refund or "roll over" their outstanding debt, thus increasing the shortrun sensitivity of FICBs to changes in their marginal financing costs.

To overcome these shortcomings, two alternative reduced-form models were estimated. One model included the change in loans outstanding in the model while the other allowed for a shift in the function beginning in 1980. While both of the alternative models yielded superior in-sample results when compared with the basic model, the out-of-sample forecast results were inferior to the basic model. Therefore for prediction purposes, it's better to use the basic model fitted to the most current data available.

Deriving the Basic Model

An unrestricted reduced-form approach was used to model PCA interest rates. The unrestricted reduced-form approach used in this paper has been used extensively in other interest rate forecasting models. Unrestricted reduced-form models simply regress the endogenous variables on the predetermined variables of the underlying structural model. On the other hand, the structural approach to modeling estimates the individual parameters of each equation in the model either one equation at a time or as systems of equations. The structural approach makes use of restrictions such as omitted variables and equivalence conditions to solve for the values of the parameters in the model.

Among the advantages of using unrestricted reduced-form models for forecasting as compared with structural models re the general ease with which the models can be conructed and the reduced problem of specification error in ne equation tending to cause forecasting problems for the odel as a whole. Implicit reduced-form equations for the ndogenous variables in a structural model can be derived hich are functionally dependent on the restrictions imposed y the underlying structural model (*4* pp. 4-5, and *8* pp. 31-537).[1] Therefore, if the restrictions are incorrect in ne equation through the presence of omitted variables r incorrect functional form, the in-sample as well as the ut-of-sample model solutions can suffer.

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owever, reduced-form equations often make less use of eory than fully structured models and can have serious rawbacks such as spurious correlation which can cause roblems in out-of-sample forecasts. For these reasons, the -sample and out-of-sample predictive ability of this elatively simple reduced-form model could be compared ith a complex structural model with endogenous equations elating to the demand for funds at PCAs and the supply of unds at PCAs. Equations that would need to be built in a ully specified model would include those relating to both ternal and external fund generation by the Farm Credit ystem (FCS), the interest spread between Farm Credit ystem securities and comparable Treasury securities, and oan demand at PCAs. The specification and estimation of model of this type would be a very large undertaking hich may provide only marginally better forecasts than the imple reduced-form equation developed in this paper. inally, a simple reduced-form model could be more easily ncluded in a large, integrated agriculture/nonagriculture acromodel.

he determination of Production Credit Association interst rates may be viewed as a two-stage procedure. The first tage consists of determining the average costs of funds to CAs from the FICBs. The second stage consists of determinng the PCA rate given the average cost of funds from the ICBs.

he first stage consists of determining the average cost of unds to the FICBs and the FICBs markup to cover current perating expenses and capital needs. In reality, the average ost of funds for the FICBs is determined jointly by the inancing needs of the PCAs and the maturity decisions of he FCS in offering securities in the Nation's debt markets. n modeling the average cost of funds to FICBs, the average ost of funds should be broken down into various maturity anges. The maturity breakdown is important because FICB nd PCA rates will lag money market rates and display less hortrun volatility. Breaking down maturity ranges into the verage cost of short-term funds, intermediate-term funds, and long-term funds explicitly takes into account that the longer the term to maturity of the debt obligations, the slower the debt will be rolled over. Therefore, the average cost of long-term funds for Federal Intermediate Credit Banks will change much more slowly than the average cost of short-term funds for a prolonged change in new borrowing costs.

Notationally, the average cost of funds to PCA's from the FICBs may be written as the following:

$$\text{FICB}_t = a + b_1\overline{\text{ST}}_t + b_2\overline{\text{INT}}_t + b_3\overline{\text{LT}}_t \tag{1}$$

where $\overline{\text{ST}}$, $\overline{\text{INT}}$, and $\overline{\text{LT}}$ represent the average cost of short-, intermediate-, and long-term debt, respectively, the constant term represents the average markup for funds in order to meet the operating expenses of the FICBs, and t is equal to time. The slope coefficients represent the relative ratios of short-, intermediate-, and long-term debt to total debt outstanding for the FICBs.

To aid in the integration of the model, Treasury yields were substituted for FCS security yields. The coupon interest rate on Farm Credit Securities is almost always above those of comparable Treasury issues, although the spread has been somewhat variable. As pointed out by Garbade and Hunt, the interest spread predominantly reflects the poorer liquidity of FCS securities compared with Treasury securities. Futhermore, Garbade and Hunt empirically found the liquidity premium to vary over time and be primarily dependent on the term to maturity of the security and the general level of interest rates. In recent years, the spread of 6-month Farm Credit bonds over 6-month Treasury bills quoted on a coupon equivalent basis has normally been under 50 basis points.

The second stage in determining PCA rates concerns the additional interest charged by PCAs above their cost of funds from the FICBs. Among the various factors which may influence their markup are their capital needs and operating surpluses. This second stage is likely to be difficult to model because it varies from PCA to PCA, and over time. However, conditions causing a change in the markup are likely to persist from quarter to quarter.

The data series used for the PCA rate was the median PCA rate charged on the first day of each quarter. Therefore, since we are dealing with the PCA rate on the first day of the quarter, the relevant cost of funds variable to PCAs would be the average FICB rate on that date also. This equation may be written:

$$\text{PCA}_t = \text{A} + \text{B FICB}_t + \text{E}_t. \tag{2}$$

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[1] Italicized numbers in parentheses refer to items in the eferences at the end of this article.

In the previous equation, A represents the average markup for funds charged by the FCS, B represents the slope coefficient for the average cost of funds to the FICBs, and E_t is an error term representing unspecified other factors influencing the markup on funds charged by the FCS. Since one of the criteria of this paper is to develop a model that could be included with little difficulty in current quarterly macromodels, Treasury yields were used to approximate the FICB rate. After trying many lag specifications, the final form of the model estimated was:

$$PCA_t = a + b_1 ST_{t-1} + b_2 \overline{ST} + b_3 \overline{INT} + B_4 \overline{LT} + e_t \qquad (3)$$

where:

PCA_t = median Production Credit Association interest rate on the first day of current quarter. (The construction of the variable drastically limits the impact of this quarter's Treasury rates on PCA interest rates.)

a = average markup for funds charged by FICBs and PCAs plus the average forecast error of the proxy variables in approximating the FICB rate over the sample period.

ST = the marginal cost of new funds to PCAs last quarter. The proxy for this variable is the 6-month new issue Treasury bill rate. In order to avoid multicollinearity problems, no other contemporaneous interest rates are used as explanatory variables.

$\overline{ST} = \sum_{i=2}^{3} ST_{t-i}/2$ average cost of pre-existing stock of short-term funds beginning last quarter proxy. (i equals an array of whole numbers as indicated.)

$\overline{INT} = \sum_{i=2}^{13} INT_{t-i}/12$ average cost of pre-existing stock of intermediate-term funds beginning last quarter proxy. The proxy variable used was the 3-year constant maturity Treasury bond rate.

$\overline{LT} = \sum_{i=2}^{21} LT_{t-i}/20$ average cost of pre-existing long-term funds beginning last quarter proxy. The proxy variable used was the 5-year constant maturity Treasury bond rate.

e_t = the random error in explaining PCA interest rates.

Empirical Results

The results of the basic regression were as follows:

$$PCA_t = \underset{(4.55)}{2.00} + \underset{(12.91)}{.31\, ST_{t-1}} + \underset{(16.25)}{.41\, \overline{ST}} + \underset{(2.57)}{.30\, \overline{INT}} - \underset{(-.08)}{.08\, \overline{LT}} + \underset{(4.40)}{.56 e_{t-1}} + u_t \qquad (4)$$

sample period = 1969II-79IV (43 observations)
Durbin-Watson = 1.74
R^2 = .990
standard error = .105

As the regression indicates, $\overline{LT}$ was not significantly different from zero and its subsequent deletion did not alter the other coefficients; therefore, it was dropped from the equation. Thus, after adjusting for first order autocorrelation by the Cochran-Orcutt procedure, the model took on the final form with e_{t-1} representing last period's error and u_t representing the part of this period's error that is uncorrelated with last period's error term. The t statistics are in parentheses.

$$PCA_t = \underset{(4.71)}{2.00} + \underset{(14.56)}{.31\, ST_{t-1}} + \underset{(16.49)}{.41\, \overline{ST}} + \underset{(4.93)}{.30\, \overline{INT}} + \underset{(4.37)}{.55 e_{t-1}}\; u_t \qquad (5)$$

sample period = 1969II-79IV (43 observations)
Durbin-Watson = 1.74
R^2 = .990
standard error = .104

This equation was then used to simulate PCA rates for 1980 and the first three quarters of 1981. The forecast errors and their standard deviations in terms of basis points are shown in table 1.

Table 1—Out-of-sample forecast errors for the basic model in basis points

Year and quarter	Forecast error	Standard deviation of forecast error	t-ratio
1980 I	25	16	1.562
1980 II	89	19	4.684
1980 III	52	20	2.600
1980 IV	–21	20	–1.050
1981 I	12	23	.522
1981 II	47	26	1.808
1981 III	09	29	.310

early, the forecast errors are large with respect to their andard deviations for the second and third quarters of)80. To be specific, the ratio of the forecast error to the andard deviation of the forecast error was only significantly fferent from zero at the 1 percent significance level for the cond and third quarters of 1980. The high t values in these riods indicate that the relatively large error terms are flecting factors other than random forecast error. Even ıen the sample size was enlarged to include 1980, the in- mple error term was large with respect to the standard viation of the error term. This may be seen by refitting e original equation with 1980 data and examining the siduals for 1980.

$$PCA_t = \underset{(3.97)}{1.48} + \underset{(15.06)}{.37}\, ST_{t-1} + \underset{(12.98)}{.39}\, \overline{ST} + \underset{(5.48)}{.33}\, \overline{INT}$$

$$+ \underset{(3.38)}{.44}\, e_{t-1} + u_t \qquad (6)$$

mple period = 1969II-1980IV (47 observations)
urbin-Watson = 1.45
^{2} = .990
andard error = .161

Table 2—Residuals in basis points for 1980 for the basic model fit through 1980

Year and quarter	Residual
1980 I	9
1980 II	53
1980 III	12
1980 IV	–53

ıe residual for the second quarter of 1980 was over three nes its standard deviation. The reason for the large positive sidual is that the model failed to account for the somewhat ıusual financing needs of the PCAs and FICBs during this riod. Very strong credit demand existed at PCAs during e first quarter of 1980 which led to strong financing needs r the FICBs. Furthermore, over half of the roughly $1.14 llion in new cash raised during the first quarter was raised tween March 3 and April 1 with no individual maturity ceeding 9.13 months (*3*). The rapid expansion of short- rm debt caused the average maturity of the debt outstand- g to decline from 1.19 years on January 2 to 1.12 years on pril 1. This peak activity in debt issuance by the FICBs in e spring of 1980 occurred during the peak in short-term terest rates for the first half of the year. The large positive sidual in the second quarter of 1980 may also be partly responsible for the offsetting negative residual in the fourth quarter and the decline in the Durbin-Watson statistic due to restrictions the normal equations place on the residuals and the strong secular trend in the explanatory variables.

In addition to the evidence of possible misspecification indicated by examining the residuals, the inclusion of 1980 in the sample period also indicated a significant change in the parameter for the lagged 6-month Treasury bill. The coefficient for the lagged 6-month bill estimated for the second quarter of 1969 to the fourth quarter of 1980 was found to be significantly different at the 1-percent significance level from the coefficient estimated for the same model excluding 1980. To be specific, the coefficient for the Treasury bill increased from .31 to .37. The values of the other coefficients in the model did not change significantly. The reason for the increase in the coefficient for the lagged Treasury bill can be attributed to the continuing shortening in the debt structure by the FICBs throughout the late seventies and 1980 and the continued strong growth in credit demand at PCAs which raised the new cash needs of the FICBs.

A number of factors were responsible for the strong credit demand at PCAs, particularly during the first half of 1980. Agricultural commercial banks were suffering high loan-to-deposit ratios and slow deposit inflows caused by deteriorating farm income, transportation problems in the northern and western fringe of the Corn Belt in early 1980, and strong competition from nonbank financial intermediaries (*10*, *7*). These factors, along with reduced bank liquidity caused by high interest rates and the implementation of credit controls, reduced the ability and willingness of agricultural banks to further expand farm lending. Specifically, the implementation of credit controls undoubtedly caused some confusion and uncertainty at agricultural banks as well as drying up funds normally available to the agricultural banks from their nonagricultural correspondent banks.

Futhermore, PCA rates have tended to be lower and less volatile than agricultural loan rates at commercial banks since 1979 due in part to the legalization of small money market certificates at commercial banks beginning in 1978 and the general rise in money market interest rates since 1978. Therefore, PCA interest rates increased less than interest rates on nonreal estate farm loans at commercial banks in early 1980. The widening spread between PCA rates and short-term agricultural loan rates at commerical banks encouraged, where possible, the substitution of PCA loans for commercial bank loans. Finally, 1979 and 1980 saw sizeable increases in noninterest production input expenses and acreage which tended to increase the demand for farm production loans in nominal terms.

Evaluation of Two Variants of the Basic Model

As indicated by the residuals and the change in the coefficient of one of the parameters, some change in the structure of the basic model has likely occurred in recent years. In order to allow for structural change, two variants of the basic model were used. The first variant was a nonstochastic varying parameter model while the second variant simply allowed for a shift in the value of certain parameters beginning in 1980. Both models yielded better in-sample simulations but unfortunately yielded inferior out-of-sample results.

The first variant of the model incorporated a nonstochastic varying parameter model. The advantage of a varying parameter model is that the parameter values are allowed to vary in relation to other variables. Therefore, other than postulating (as in normal regression analysis) that a variable enters into the model in a simple additive manner with no impact on the other coefficients, the varying parameter approach allows the variable to enter in a multiplicative manner which influences the value of the other coefficients directly.

The two basic types of varying parameter models are stochastic and nonstochastic (*9*). The nonstochastic varying parameter model does not have separate disturbance terms for the varying parameters while the stochastic varying parameter model does have disturbance terms for the varying parameters. The estimation procedure is much more complex in the stochastic varying parameter model if more than one coefficient is allowed to vary. Therefore, for ease of computation as well as to avoid debates as to which stochastic varying parameter estimation technique to use, the nonstochastic varying parameter was employed.

The varying parameter approach used in modeling PCA rates implies that the coefficients for last quarter's 6-month bill rate and the average of the past 3 years' rates are functionally dependent on last quarter's seasonally adjusted percentage change in loans outstanding at PCAs from the previous year. The rationale for this relationship is that if loan demand at PCAs is high, FICBs new cash needs will likely rise, necessitating larger debt offerings. The heavy new financing requirements will raise the coefficient for the current period's interest rate and diminish the coefficient's value for past interest rates, in this case the coefficient for the pre-existing longer term funds. Notationally, the varying parameter model may be written as follows:

$$PCA_t = A + ST_{t-1}(B_1 + B_2 CHLOAN_{t-1}) + B_3\overline{ST} + \overline{INT}\,(B_4 + B_5\, CHLOAN_{t-1}) + e_t \qquad (7)$$

or:

$$PCA_t = A + B_1 ST_{t-1} + B_2(ST_{t-1} * CHLOAN_{t-1}) + B_3\,\overline{ST} + B_4\,\overline{INT} + B_5(\overline{INT} * CHLOAN_{t-1}) + e_t \qquad (8)$$

where CHLOAN is equal to the seasonally adjusted percentage change in loans outstanding from one year earlier at PCAs.

The varying parameter model yielded superior in-sample simulation results in that the varying parameter term individually and collectively improved the R^2 and produced smaller residuals for 1980 than the basic model. The estimated coefficients and residuals were as follows:

$$PCA_t = \underset{(5.58)}{1.73} + \underset{(2.08)}{.14}\,ST_{t-1} + \underset{(3.37)}{.012}\,(ST_{t-1} * CHLOAN_{t-1}) + \underset{(13.67)}{.40}\,\overline{ST} + \underset{(7.09)}{.48}\,\overline{INT} \underset{(-2.42)}{- .010}\,(\overline{INT} * LPCA_{t-1}) + \underset{(3.20)}{.42}e_{t-1} + u_t \qquad (9)$$

sample period = 1969II-80IV
Durbin-Watson = 1.55
R^2 = .993
standard error = .134

A second attempt at modeling structural change involving the basic model was made through the use of dummy variables. In particular, Gujarati's dummy variable technique for allowing a shift in the coefficients at a point in time was used. Specifically, Gujarati's procedure allows the testing of whether the coefficient estimates are significantly different in the pre-1980 and 1980 periods without explicitly having the degree-of-freedom problems normally associated with running two separate equations. Specifically, the estimated model was as follows:

$$PCA_t = \underset{(3.88)}{1.58} + \underset{(11.00)}{.29}\,ST_{t-1} + \underset{(4.37)}{.20}\,(D * ST_{t-1}) + \underset{(15.27)}{.45}\,\overline{ST} + \underset{(5.74)}{.34}\,\overline{INT} \underset{(-3.84)}{- .24}(D * \overline{INT}) + \underset{(3.19)}{.42}e_{t-1} + u_t \qquad (10)$$

$D * ST_t - 1$ = 0 for estimation of PCA rate from 1969II-79IV

* INT = 1 for estimation of PCA rate for post-1979IV observations
mple period = 1969II-80IV
ırbin-Watson = 1.68
= .993
ndard error = .134

e coefficient estimate for the impact of a 1-percentage- int change in the ST_{t-1} or INT variable is simply .29 and 4, respectively, in the pre-1980 period. For the 1980 riod, the dummy variable takes on a value of one and the tal impact of a change in ST_{t-1} or $\overline{INT}$ is equal to .49 and 0, respectively. Thus, the regression results indicate that e to the strong credit demand at PCAs and the shortening the debt structure, the impact of last period's ST rate came significantly more important while the impact of e INT variable declined significantly. The dummy variable gression results yielded superior in-sample results compared th the basic model in that a higher R^2, smaller residuals r the troublesome second and fourth quarters, and less idence of higher order serial correlation.

omparative Simulation Results

hile the in-sample results were superior for the two more mplicated versions of the basic model, the primary objec- ve of these models is forecasting. Therefore, the primary iterion should be the out-of-sample simulation results r the recent past. Thus, the simulation errors for the first ree quarters of 1981 based on the coefficient estimates otained from the 1969II-80IV sample period are shown in ble 3 with the standard deviation of the forecast error in arentheses.

Table 3—Comparative simulation forecast errors, 1981

Model	First quarter	Second quarter	Third quarter
asic	−.05 (.25)	.16 (.24)	−.29 (.26)
arying parameter	.55 (.26)	.80 (.26)	.33 (.27)
ummy variable	−.28 (.22)	−.05 (.27)	−.56 (.37)

learly the basic model was superior to its more complicated unterparts for out-of-sample simulation results. The rying parameter model consistently underpredicted the rst three quarters of 1981. Apparently the varying param- er model overestimates the impact of slower loan growth PCAs in 1981 relative to 1980. Furthermore, the equation likely fails to account for the movement toward a shorter maturity structure over time. Conversely, the dummy variable model has a tendency to overforecast this period. This is likely due to the fact that the model overestimates the impact of the general rise in interest rates for the first half of 1981 by failing to take account of the slower rate of growth in PCA loan demand during 1981.

Summary and Conclusions

The simulation results indicate further research may warrant examining whether a combination varying parameter/dummy variable model performs superior to the basic model. A researcher may want to obtain the unpublished data back to 1969 on the debt outstanding of FICBs and construct reduced form and structural models to predict the FICB rate explicitly. However, the basic model appears to do a very creditable job of simulation provided the model is reestimated to include the most recent data, and growth in credit demand at PCAs is not near cyclical peaks. Given the extreme volatility and difficulty in forecasting interest rates, errors in forecasting the exogenous variables likely will be a much larger source of forecast error than any specification error present in the basic model. Specifically, the forecasts of the exogenous variables have been complicated by the recent shifts in the demand for money, the increased volatility of interest rates that has likely increased the liquidity premium on long-term interest rates, the concern over future budget deficits, and the instability in the real sector.

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Mandatory Equity Retirement Plans
nd Cooperative Strength

y Wilmer A. Dahl, William D. Dobson, and Duane H. Veium*

Abstract

America's agricultural cooperatives are experiencing pressures from members and legislators to lessen financial sacrifices of members and retire equity capital of members who die, retire, or leave the cooperative's service area. Proposals have been raised as to the feasibility of cooperatives adopting mandatory equity retirement practices to remedy various management problems. Results of a study conducted in Wisconsin, however, suggest that mandatory equity retirement plans could severely reduce solvency and financial strength for most cooperatives included in the study.

Keywords: Cooperative finance; Equity capital redemption; Cooperative growth; Public policy

troduction

ost farmer cooperatives in the United States use revolving nds to finance their operations and expansion. These funds e derived primarily from capital deductions from members d/or margins realized from the cooperative's current erations. In theory, a cooperative will use earnings genered during the current year to retire the oldest capital rnished by members. Hence, the name "revolving fund."

evolving-fund financing has always been controversial spite its desirable characteristics of keeping cooperative nership in the hands of current members and securing ancial contributions from members in proportion to their e of the cooperative. As Schaars noted in 1963, many volving funds "don't seem to revolve." Citing a "ground ell of criticism" among members, he called upon farmer operatives to correct this problem or otherwise risk lienating members from the cooperative" (*18*).[1]

ebate in the U.S. Congress and several State legislatures, cluding Wisconsin, as well as several court cases have cused on this problem. While none of the efforts aimed establishing mandatory equity-retirement plans have been successful, such efforts probably will continue, much to the dismay of cooperatives which view such a requirement as a threat to their financial well-being.

This paper examines the effect mandatory equity retirement would have on the solvency and financial strength of cooperatives. Much of the discussion is based on a follow-up study of Wisconsin farm supply cooperatives.

Previous Studies

In 1977, Brown and Volkin estimated that 32 percent of the Nation's farmer cooperatives carried out systematic programs for retiring equity capital:[2] 39 percent retired equities under special circumstances, such as death or member retirement; and the remaining 29 percent had no program (*1*). A 1980 survey of 183 Wisconsin cooperatives showed that 20 percent of the firms had no equity redemption plans (*14*).

Many authors and cooperative officers suggest that cooperatives would reap two important benefits if they established their own systematic equity retirement programs. First, these programs would help to attract business and retain members and, second, they would cancel the need, as perceived by some policymakers, for legislating mandatory programs.

The widely held view among cooperative leaders is that the inflexibility of mandatory programs would jeopardize the solvency and drain the financial strength of cooperatives. This view also is generally held by those who have studied equity retirement issues. However, some authors conclude that cooperatives could do more to implement effective equity retirement plans. For example, Brown and Volkin said, "our own view is that some sort of program can be adopted by practically all cooperatives if there exists a determination to plan and budget for equity redemption" (*1*). The General Accounting Office (GAO) also recognized the merits of voluntary equity retirement plans, but recommended that "if cooperatives are not willing to adopt more equitable redemption programs voluntarily, the Secretary (of Agriculture) should develop a legislative proposal to make it mandatory for cooperatives to:

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[1] Italicized numbers in parentheses refer to items in the eferences at the end of this article.

[2] Equity capital refers to the investment of members in the cooperatives. It includes such balance sheet items as common stock, preferred stock, certificates of equity, allocated savings (book credits), and unallocated savings (reserves).

1. pay interest or dividends on retained equities,
2. retire retained equities within a certain time, or
3. pay interest or dividends on retained equities and retire retained equities within a certain time.

The legislation should include a clause that cooperatives that do not comply with the requirement would lose their tax exemption status" (*4*).

Conley and Lewis, who examined the financial structure of Illinois grain cooperatives from 1973-77, reported that grain cooperatives with equity-retirement programs did not face a significantly greater number of financial obstacles to equity retirement than did those without programs. In regard to financial structure, Conley and Lewis found "no differences in total assets and net worth, but program cooperatives used a significantly greater amount of term debt than did no-program cooperatives. . . . The liquidity and equity positions of program and no-program cooperatives were comparable (not significantly different statistically)" (*5*).

In 1976, Dahl and Dobson reported that a mandatory equity-retirement program would substantially reduce the solvency of cooperatives within 2 years after the program was initiated (*7*). Since the 1976 study was based on balance sheet data for 1966-72 and certain extrapolations for 1973 and 1974, the study was updated to determine whether conclusions about the effects of a mandatory program would be changed if more recent balance sheet figures (1973-80) were analyzed.

Study Objective

The primary objective of the study was to determine how a specified mandatory equity-retirement plan would affect the solvency and financial strength of Wisconsin farm supply cooperatives. The plan analyzed would require the cooperatives each year to systematically retire equity capital held by members who retire, die, or leave the area served by the cooperative. This type of plan is strongly favored by farmer members (*4*, *15*). The hypothetical plan also calls for the cooperatives to replace the equity retired with long-term debt.

The study was based on figures provided by 167 local Wisconsin farm supply cooperatives for 1966-72; 171 for 1973-75; 170 for 1976; 169 for 1977; and 114 for 1978-80. The firms studied represented 88 percent of all Wisconsin farm supply cooperatives during 1966-72, 100 percent during 1973-77, and 67 percent during 1978-80.

The cooperatives were divided into four groups based on annual sales (table 1). Group 1 cooperatives had annual sales of less than $1 million; Group 2, $1-2 million; Group 3, $2-3 million; and Group 4, more than $3 million. Balance sheets for each cooperative, as well as for the average (representative) cooperative in each group, were modified to reflect the effects of imposing the hypothetical mandatory plan; specifically, equity capital retired under the plan was replaced with long-term debt according to the percentages specified in table 1. Estimates of the percentage of equity held by members who retire, die, or leave the cooperatives each year were developed from figures reported in the original Dahl-Dobson study. These figures were based on interviews with a stratified random sample of employees of 83 of the cooperatives in 1974. They represent percentages, based on historical experience, of equity capital over and above the generally small percentages of capital paid out by cooperatives annually under any equity-retirement plans.

Effects on Solvency

Solvency of the cooperatives under the hypothetical mandatory equity-retirement plan was measured using the familiar

Table 1—Average annual percentage of cooperative's equity capital held by members who die, retire, or leave trade area

Cooperative group	Annual sales	Cooperatives in group, 1977	Average equity held by members leaving cooperative, 1966-74
	Dollars	*Number*	*Percent*
1	Less than 1,000,000	34	9.14
2	1,000,000-2,000,000	55	8.85
3	2,000,000-3,000,000	40	8.48
4	More than 3,000,000	40	8.48

o of debt to equity capital, which reflects the firm's lity to meet long-term obligations. As the ratio of debt equity increases, a creditor's protection declines. Gries l Torgerson suggested that an appropriate total debt/ al equity ratio for a farm supply cooperative is 80-100 cent (*10*). When the debt-equity ratio exceeds 100 percent, cooperative's equity capital may be approaching a level t cannot protect creditors from losses. However, debt- ity ratios for many farm supply firms have exceeded) percent in recent years. For example, the Robert Morris dian debt-equity ratios for farm supply firms in the ited States and Canada have exceeded 100 percent since early seventies. This increase in percentage of debt used l to be taken into account in the study. Thus, both the bert Morris and Gries-Torgerson figures were used as gets, or standards, in analyzing the impact of the manda- y equity-retirement plan.

erage Cooperative for Population

e debt-equity ratios during 1966-80 for (1) the average sconsin farm supply cooperative operating under the ndatory equity-retirement plan, (2) the median debt- ity ratios for the Robert Morris Associates farm supply ns, and (3) the actual debt-equity ratios for the average sconsin farm supply cooperative appear in figure 1. Under the mandatory plan, the debt-equity ratios for the average cooperative would have exceeded 100 percent (the upper boundary of the Gries-Torgerson target) after the plan had been in operation for about 3 years. The debt-equity ratio of the average cooperative would have been about 238 percent in 1980, and it would have exceeded the Robert Morris benchmark figures beginning in about 1968 and continuing through 1980. The relatively constant actual debt-equity ratios (lowest line in fig. 1) over the 15-year period indicate that the mandatory equity-retirement plan would have caused a substantial decline in the solvency of cooperatives that otherwise would have maintained strong solvency positions.

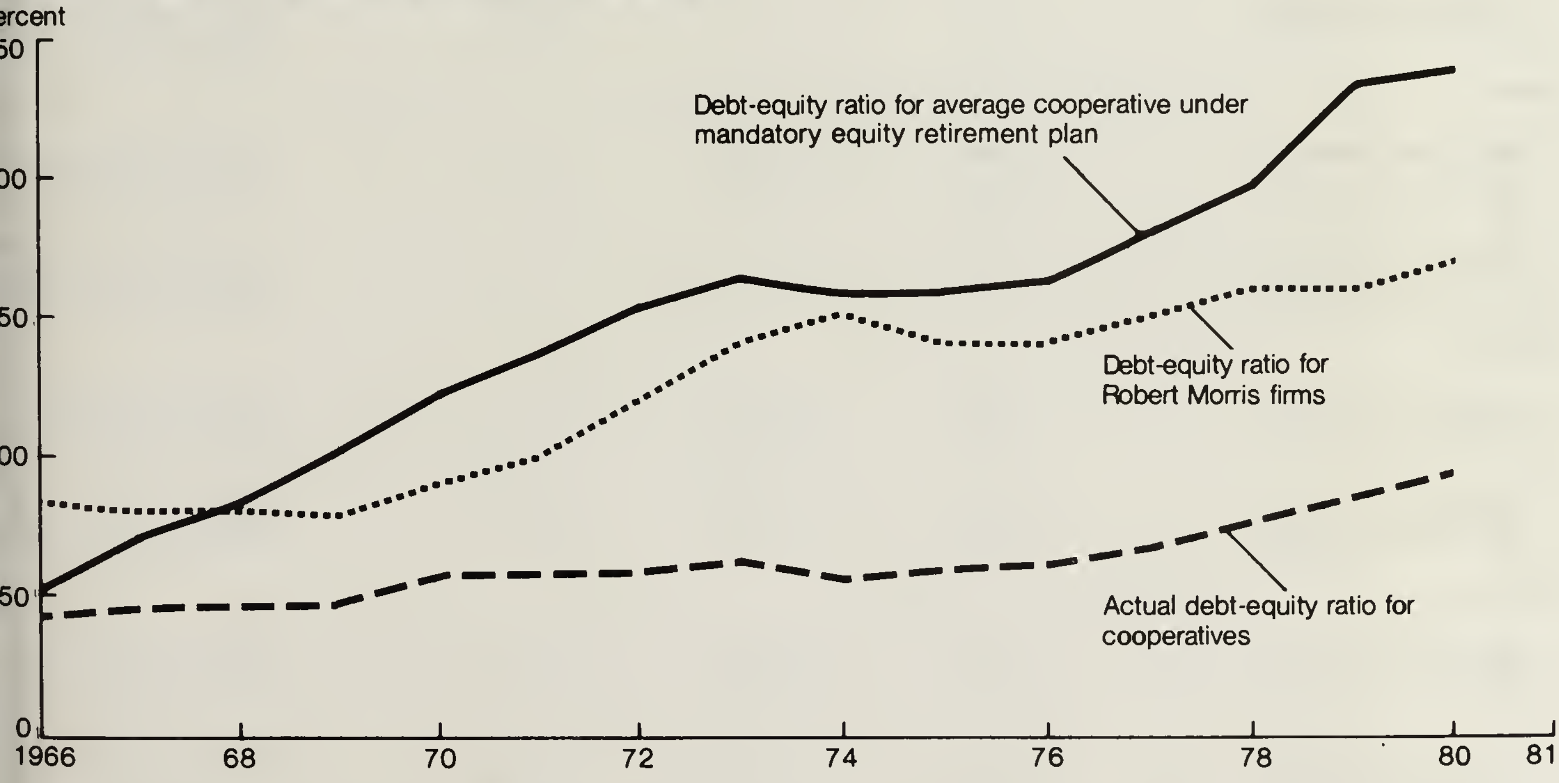
Individual Cooperatives

The effect of a mandatory equity-retirement plan may vary according to cooperative size. Therefore, the effects of the mandatory plan for each cooperative in Groups 1, 2, 3, and 4 were examined. Most of the firms recorded relatively strong actual debt-equity ratios over the 1966 to 1980 period (tables 2 and 3).

The Gries and Torgerson study also suggested that an appropriate long-term debt-equity ratio (commonly referred to as a leverage ratio) for a farm supply cooperative is between

gure 1

bt-Equity Ratios for Wisconsin Farm Supply Cooperatives



.50-.60 (*10*). Note in table 2 that only 4 percent of the Group 3 firms and 18 percent of the Group 4 firms recorded long-term debt/total equity ratios in excess of .65 under the actual structure in 1980. Had it been mandatory to retire equity capital and replace that capital with long-term debt under the hypothetical plan, 92 percent of both groups of cooperatives would have exceeded the .65 ratio by 1980. Therefore, only 8 percent of these larger firms would have recorded long-term debt/total equity ratios within the guidelines prescribed by Gries and Torgerson.

Although changes in the leverage ratio experienced by the relatively smaller cooperatives in Group 1 and Group 2 were not as severe as those recorded for the larger firms in Groups 3 and 4, significant changes still developed over the 1966-80 period. Study results indicate that 18 percent of the Group 1 firms recorded actual long-term debt/total equity ratios greater than .65 in 1980 compared with 70 percent under the hypothetical mandatory equity retirement plan: a difference of 52 percent (table 2). Comparatively, the Group 2 cooperatives show a difference of 66 percent; 15 percent of the firms had long-term debt/total equity ratios in excess of .65 in 1980 under the actual structure, and 81 percent of the firms were above the .65 level under the mandatory plan for the same year.

Evidence suggests that the larger cooperatives had a relatively greater need for outside sources of long-term loans as the

Table 2—Long-term debt/total equity ratios under the actual structure and mandatory equity retirement plan structure for Wisconsin farm supply cooperatives, 1966 and 1980

Year, group, and structure	Long-term debt/total equity				
	Less than .26	.26-.45	.46-.65	.66-1.05	Greater than 1.05
	Percent of firms				
Group 1:					
1966 actual structure	76	9	3	3	9
1966 mandatory plan	68	11	6	6	9
1980 actual structure	59	17	6	6	12
1980 mandatory plan	0	10	20	30	40
Group 2:					
1966 actual structure	85	9	2	4	0
1966 mandatory plan	72	20	2	2	4
1980 actual structure	60	11	14	9	6
1980 mandatory plan	0	0	19	19	62
Group 3:					
1966 actual structure	90	5	5	0	0
1966 mandatory plan	75	18	5	2	0
1980 actual structure	62	17	17	0	4
1980 mandatory plan	0	0	8	25	67
Group 4:					
1966 actual structure	59	21	5	10	5
1966 mandatory plan	44	15	23	12	6
1980 actual structure	47	26	9	12	6
1980 mandatory plan	0	0	8	17	75

pothetical mandatory retirement plan was implemented ring the 1966 to 1980 period. This larger need was prob- ly due to the fact that the larger cooperatives expanded eir operations at a relatively faster pace than the smaller ms over the 15-year period. Firm expansion, combined th the mandatory retirement of capital, created a financial ucture where severe shortages of equity capital developed.

indicated previously, Gries and Torgerson suggested a tal debt/total equity ratio guideline ranging from .80-1.00. 1980, 66 percent of the Group 3 cooperatives recorded tual total debt/total equity ratios less than or equal to 05. Specifically, table 3 shows that 45 percent of the firms corded a ratio within the .50 to 1.05 range, while 21 percent recorded a ratio less than .50. By 1980, under the mandatory equity-retirement plan, however, 100 percent of the Group 3 firms had total debt/total equity ratios greater than 1.05 under the mandatory plan; 17 percent of the firms were between the 1.05 to 1.55 range, while 83 percent recorded ratios in excess of 1.55.

Under the mandatory plan, substantial reductions in solvency (total debt/total equity) were also exhibited by cooperatives in the other size groups over the 1966-80 period. By 1980, 38 percent of the Group 2 cooperatives recorded actual total debt/total equity ratios greater than 1.05, while 89 percent of these same firms recorded a solvency ratio in excess of 1.05 under the mandatory retirement plan (table 3).

Table 3—Total debt/total equity ratios under the actual structure and mandatory equity retirement plan structure for Wisconsin farm supply cooperatives, 1966 and 1980

Year, group, and structure	Total debt/total equity				
	Less than .50	.50-.85	.86-1.05	1.06-1.55	Greater than 1.55
	Percent of firms				
oup 1:					
1966 actual structure	63	17	6	0	14
1966 mandatory plan	57	14	9	6	14
1980 actual structure	39	33	11	6	11
1980 mandatory plan	0	12	19	25	44
oup 2:					
1966 actual structure	67	21	4	2	6
1966 mandatory plan	59	29	2	2	8
1980 actual structure	22	27	13	19	19
1980 mandatory plan	4	0	7	19	70
oup 3:					
1966 actual structure	72	20	3	3	2
1966 mandatory plan	55	33	8	2	2
1980 actual structure	21	41	4	17	17
1980 mandatory plan	0	0	0	17	83
oup 4:					
1966 actual structure	44	28	3	15	10
1966 mandatory plan	36	33	3	15	13
1980 actual structure	18	26	9	18	29
1980 mandatory plan	0	3	0	16	81

For the Group 1 cooperatives, 17 percent of the firms recorded actual total debt/total equity ratios greater than 1.05 in 1980, compared with 69 percent under the mandatory plan for the same year.

The weakest relative solvency position was recorded by the Group 4 cooperatives over the 1966 to 1980 period. Specifically, 25 percent and 47 percent of these larger firms recorded actual total debt/total equity ratios greater than 1.05 in 1966 and 1980, respectively. During this same period under the mandatory equity-retirement plan, the percent of firms recording total debt/total equity ratios in excess of 1.05 increased from 28 percent in 1966 to 97 percent in 1980.

Results of the mandatory equity-retirement plan in tables 2 and 3 clearly indicate that by 1980 only a small percentage of the cooperative firms would record a long-term debt/total equity ratio within the .5- to .6-range and a total debt/total equity ratio within the .8- to 1.0-range prescribed by Gries and Torgerson. Since these ratios measure "what is owed to what is owned," the creditors' interests in the business assets by 1980 would be substantially greater than the owners' interests for most of these cooperatives under the mandatory retirement plan. Such results suggest that as the creditors' interests increase and the owners' interests decline, greater control of the cooperative would be demanded and subsequently transferred to creditors.

Average Cooperative by Group

The effects of the mandatory plan on the average cooperative in Groups 1, 2, 3, and 4 were also examined. For clearer presentation, a variable, called DIFF, was developed for the average cooperative in each of the four different size groups (fig. 2). This variable combines certain pieces of information relating to solvency. Specifically, DIFF equals the total debt/total equity ratio of the representative cooperatives under the mandatory equity retirement plan, $(D/E)_{MER}$, minus the Robert Morris median total debt/total equity ratio, $(D/E)_{RM}$. DIFF becomes positive and "out of line" with the industry benchmark figures when a cooperative's total debt/total equity ratio rises above the Robert Morris standards.

As noted previously, the solvency of the Group 4 cooperatives declined most sharply under the mandatory equity-retirement plan over the 1966-80 period. The solvency ratio for the average Group 4 cooperative exceeded the Robert Morris benchmark figures after only 1 year and remained "out of line" for the remaining 14 years studied. The average value of DIFF recorded for these larger cooperatives during 1966-80 was 39 percent. DIFF peaked at 56.37 percent in 1970, declined through 1974, and increased to 100.21 percent in 1980.

The pattern of change in the solvency ratios for the Group 4 cooperatives could be expected, since these cooperatives normally use higher amounts of debt capital than their smaller counterparts. For example, during 1980, the total debt/total equity ratio of the average Group 4 cooperative was 109 percent, compared with 64, 86, and 83 percent, respectively, for the average cooperative in Groups 1, 2, and 3. When the Group 4 cooperatives used still more debt to replace equity capital under the hypothetical equity-retirement plan, the total debt/total equity ratio for these firms was pushed to the higher levels shown in figure 2.

The cooperatives that maintained the highest level of solvency under the mandatory equity-retirement plan were those in Group 1, although the solvency of these firms also deteriorated significantly. The average value of DIFF for the Group 1 firms during 1966-80 was 7.85 percent. The largest positive value of DIFF for these firms (41.69 percent) was recorded in 1979.

The debt-equity ratios for the Group 2 and Group 3 cooperatives rose above the Robert Morris standard ratios after the hypothetical mandatory equity-retirement plan had been in operation for 3 years or less. However, the deterioration in solvency for these relatively smaller firms was not as severe as that for the Group 4 firms. The average value of DIFF for the average Group 2 and Group 3 cooperatives during 1966-80 was 14.66 percent and 15.92 percent, respectively.

The debt-equity ratios in figure 2 suggest that a mandatory equity-retirement plan would affect the solvency of cooperatives of different sizes in nonuniform ways and would have varying effects on the solvency of cooperatives from year to year. In years such as 1974, when savings of the cooperatives were high, such a plan might not be difficult for the cooperatives to employ. However, in most years such a plan would seem to reduce solvency of the cooperatives substantially.

Effects on Financial Strength

A measure of the financial strength of a cooperative is the ratio of total equity to total assets, which shows the percentage of a cooperative's assets that are financed by member equity capital. In general, the higher the ratio, the stronger the financial condition of the cooperative. Gries and Torgerson suggest that farm supply cooperatives might aim for a 50-55 percent target for this ratio (*10*).

Table 4 shows the percent of Wisconsin farm supply cooperatives recording total equity/total asset ratios within certain prescribed ranges during 1966 and 1980 under the actual structure and the hypothetical mandatory equity-retirement plan. In all four different size groups, most of the cooperatives maintained actual total equity/total asset ratios above or within the 50-55 percent target range from 1966 to 1980.

each group of cooperatives, however, the respective os weakened considerably under the mandatory equity-rement plan. In most cases, the total equity/total asset o fell substantially below the 50-55 percent target within -year period after the mandatory retirement plan was lemented.

e Group 4 cooperatives again recorded the weakest relative ition during the 1966-80 period. In 1980, 50 percent of Group 4 firms recorded actual total equity/total asset ios above .50 compared with only 3 percent under the ndatory equity-retirement plan. Table 4 also shows that percent of the Group 4 firms would have total equity/ al asset ratios less than .35 by 1980 under the mandatory n. In other words, less than 35 cents of each dollar of perative assets would be supported by member-equity ital for almost three-quarters of these larger firms; the aining 65 cents would be financed by debt capital.

e Group 2 and Group 3 cooperatives maintained relatively ong levels of financial strength over the 1966 to 1980 iod, where 59 percent and 67 percent of the firms, re-ctively, recorded actual total equity/total asset ratios ater than .50 in 1980. The strength of these firms, how-r, dropped substantially under the mandatory equity-retirement plan, with only 11 percent of the Group 2 firms and none of the Group 3 firms recording total equity/total asset ratios above .50 by 1980.

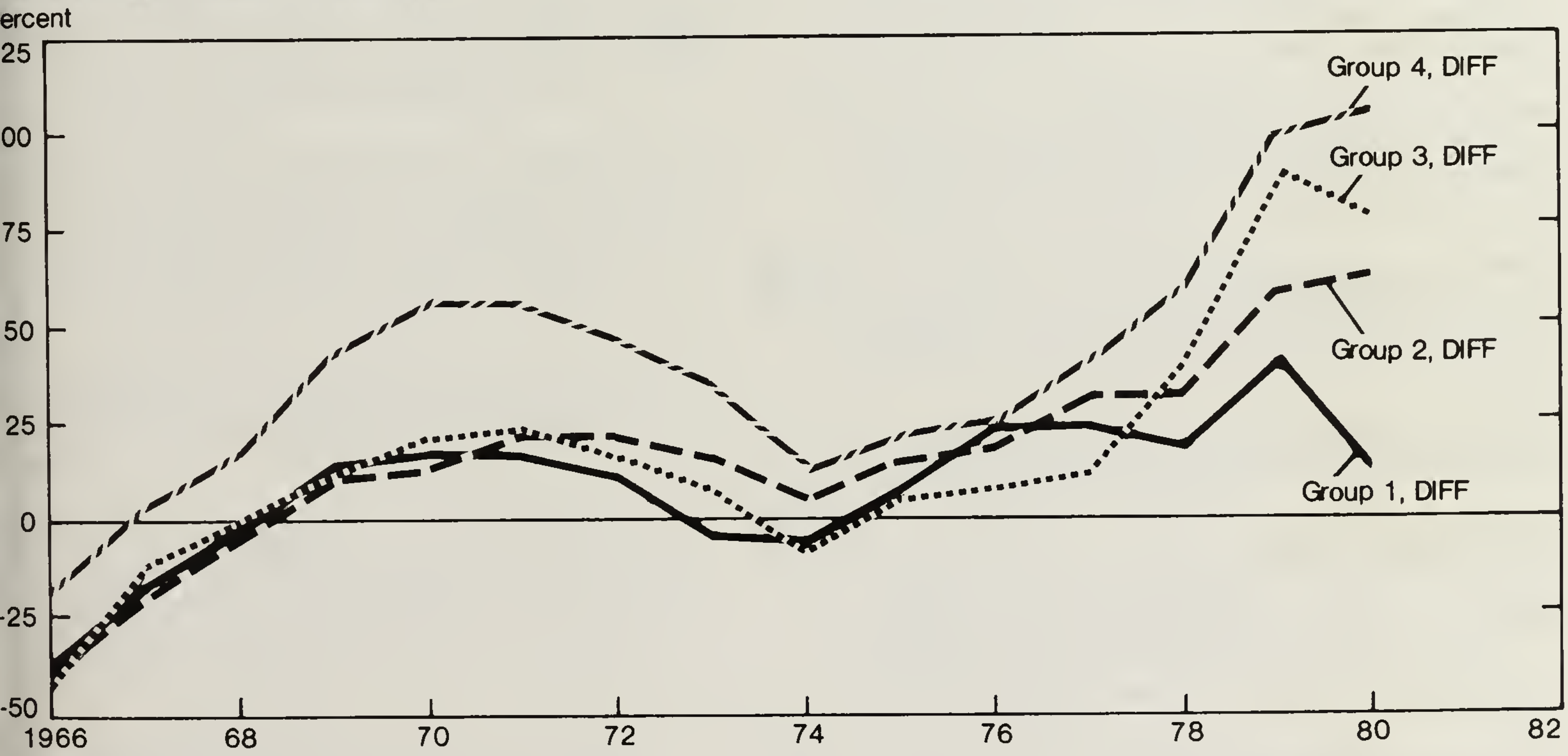
Therefore, results in Table 4 show that under the mandatory equity-retirement plan for all four groups of cooperatives, at least 70 percent of the firms would have total equity/total asset ratios less than .50 by 1980 (that is, assets supported by less than 50 percent of their members' equity capital). Such highly levered capital positions provide added evidence that substantial reductions in financial strength of the cooperatives would occur under a mandatory equity-retirement plan of the type considered in this study.

Conclusions and Recommendations

Our results suggest that it may not be feasible for many cooperatives to institute a systematic equity-retirement plan which calls for retiring 8 percent to 9 percent of member equity each year. We concede, of course, that cooperatives adopting systematic plans requiring smaller amounts of equity capital to be redeemed annually (such as that associated with selected estates) would be more feasible to implement than the hypothetical plan examined in this study.

gure 2

ebt-Equity Ratios Under Mandatory Equity-Retirement Plan Minus Robert Morris Median Debt-Equity Ratios (DIFF) for /isconsin Farm Supply Cooperatives



ootnote: DIFF= $(D/E)_{MER} - (D/E)_{RM}$

It is difficult to fully reconcile the general conclusions of this study with those of Conley and Lewis. Their "no difference" findings regarding "program" and "no-program" cooperatives caused them to conclude that ". . . concern about financial strength should not be an obstacle to an equity redemption program" (*5*). Such a conclusion cannot be drawn from the present study. However, the equity retirement plans examined in the Conley and Lewis article and the present study may not be fully comparable. For example, some of the "program" cooperatives examined by Conley and Lewis may employ plans (such as retirement of estates only) which obligate them to retire substantially less equity than the plan examined in this study. Moreover, not all results of the two studies differed. The Conley and Lewis study showed that the amount of term debt used by the "program" cooperatives was higher than that of "no-program" cooperatives. This result is consistent with the results of our study.

Cooperatives operating under mandatory equity-retirement plans would have less flexibility. The average amount of equity capital held by Wisconsin farm supply cooperatives during 1966-80 was $702,088. Therefore, if the average farm supply cooperative had to pay out $61,082 (average amount of equity held by those who die, retire, or leave the sales area during a year when margins were low, some cooperatives could be crippled financially. Also, requiring cooperatives to pay dividends on member equity would reduce the amount of money available for retiring member equity.

Table 4—Percent of firms within prescribed ranges of total equity to total assets under the actual structure and mandatory retirement plan for Wisconsin farm supply cooperatives, 1966 and 1980

Group, year, and structure	Range of total equity to total assets				
	0-.34	.35-.49	.50-.64	.65-.79	.80-1.00
			Percent of firms		
Group 1:					
1966 actual structure	14	0	20	12	54
1966 mandatory plan	14	6	17	29	34
1980 actual structure	11	5	39	17	28
1980 mandatory plan	29	41	24	6	0
Group 2:					
1966 actual structure	4	4	15	33	44
1966 mandatory plan	4	7	20	49	20
1980 actual structure	11	30	35	13	11
1980 mandatory plan	59	30	7	4	0
Group 3:					
1966 actual structure	2	2	20	28	48
1966 mandatory plan	3	5	23	52	17
1980 actual structure	12	21	46	17	4
1980 mandatory plan	74	26	0	0	0
Group 4:					
1966 actual structure	5	21	15	36	23
1966 mandatory plan	5	23	31	26	15
1980 actual structure	21	29	32	12	6
1980 mandatory plan	71	26	3	0	0

study suggests that mandatory equity-retirement plans
ooperatives could substantially reduce the solvency and
cial strength of many Wisconsin farm supply cooper-
;. These results do not suggest, however, that ways of
oving equity-retirement plans for cooperatives can be
ed. On the contrary, developments that led to drafting
ation to force cooperatives to retire equity capital are
usly important. However, it would seem advantageous
rmit cooperatives to voluntarily develop plans to retire
y capital in an orderly fashion. Voluntary plans would
for the flexibility that existing cooperatives appear
ed for their survival.

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Agricultural Record Systems and the Information Needs of Farmers and Lenders

By B. L. Jones, S. T. Sonka, and M. A. Mazzocco*

Abstract

Agricultural accounting is a major source of data for evaluating the economic performance of farm units and the agricultural sector as a whole. As interested data users adjust the scope of their analyses, their data needs change. These changes are in turn translated into adjustments in the accounting systems which gather relevant information. This report uses three surveys to identify how users of accounting systems have influenced the structure of those systems. The survey results indicate probable directions agricultural accounting will follow given the unsatisfied needs of report users.

Keywords: Financial analysis; Information needs; Accounting systems.

Introduction

The output of a farmer's accounting system is a report reflecting the farm's economic performance. Agricultural accounting methods are revised as often as the information needs of their users change. The three specific user groups are: firm managers; firm owners and investors; and external parties, such as lenders, the Internal Revenue Service (IRS), and public sector economists. Each group's changing information needs exert corresponding pressure on agricultural accounting systems. Figure 1 presents a model of how these three groups influence the accounting systems of farmers.

Because agricultural accounting is continually changing, it needs to be continually monitored. This report contributes to the monitoring process by reporting on the results of three recent surveys. Two surveys deal with data which farmers maintain for themselves and/or for lenders. The other survey examines agricultural accounting service bureaus which farmers use. Therefore, this report simultaneously examines the information requirements of farmers and lenders while reviewing the record systems available to farmers.

User Information Needs and Uses of Farm Data

In 1979, surveys were conducted in Illinois of representative samples of farmers and lenders. In both surveys, major emphasis was devoted to defining the extent to which each group is using selected financial information.

Farmer Responses

In December 1979, a survey was mailed to 600 randomly selected commercial farmers in 12 Illinois counties. For a detailed description of the sampling methodology employed in the farmer and lender surveys, see (*1*).[1]

After two mailings of the survey, 293 usable responses were received. The location of the respondents was evenly distributed throughout the State. The responding farmers averaged 47 years of age, and the majority had been farming for more than 20 years. Forty-eight percent of the respondents operated farms of less than 450 acres. However, 14 percent operated farms with more than 1,000 acres. Operating debt financing was important to many of these farmers. Over 35 percent reported borrowing at least 25 percent of their operating funds in 1979.

Over 90 percent of the farm operators responding maintaine some type of written financial records. To evaluate the present financial records of farm operators, the farmer surve examined current use of two financial reports, the balance sheet and the pro-forma cash-flow statement.

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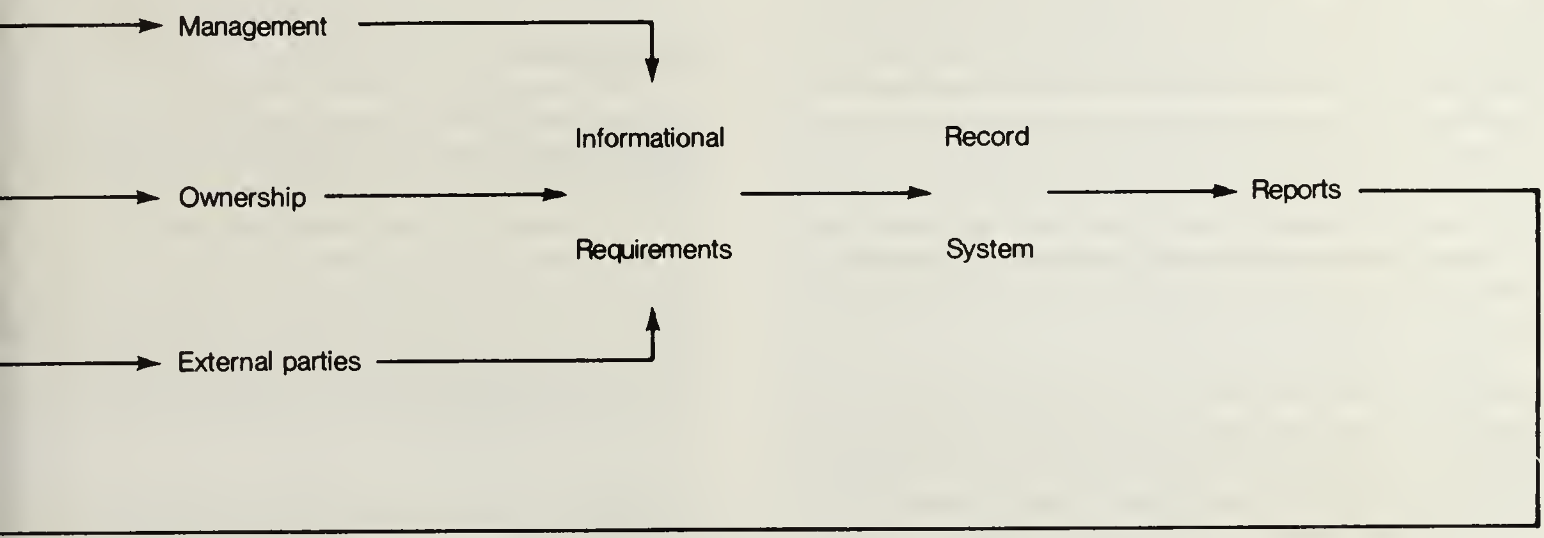
[1] Italicized numbers in parentheses refer to items in the References at the end of this article.

re 1

rmation Flow of Data



e 1 lists the extent to which the responding farmers bleted specific financial statements. Balance sheets were ared by 200 farmers, 69 percent of those responding. In rast to that relatively high percentage, 48 percent of the responding farmers prepared pro-forma cash-flow statements. Completion of a balance sheet and projecting cash flows evidently are related activities. As shown in table 1, 39 percent of the farmer respondents complete both of these statements. If a responding farmer prepared only one statement, however, that report was more likely to be a balance sheet. Almost one-quarter of the respondents completed neither a balance sheet nor a pro-forma cash-flow statement.

ble 1—Farmers who complete specific financial reports

ancial statement	Farmers completing financial statement	
	Number	*Percent*
nce sheet	200	69
orma cash flow	138	48
nce sheet and ro-forma cash flow	115	39
nce sheet but ot pro-forma cash flow	85	29
orma cash flow ut not balance sheet	23	8
her balance sheet nor ro-forma cash flow	70	24
l respondents	293	100

Over 65 percent of the farmers preparing balance sheets cited credit acquisition as their major reason for doing so. Similarly, 67 percent of those farmers who prepared pro-forma cash flows also used the statement in obtaining credit. Apparently the financial statements prepared by farmers are influenced by the information considered useful by lenders.

The responding farmers cited several additional reasons for preparing financial statements. Business analysis was cited by 58 percent as another reason for preparing balance sheets. Reasons for preparing pro-forma cash-flow statements included analyzing investment alternatives, formulating marketing strategies, and tax planning. Farmers use these financial statements to manage and analyze their businesses as well as satisfy lender requirements.

The business and personal characteristics of the respondents also were obtained (table 2). The percentage of operating funds borrowed, size of the firm, and age of the respondents were characteristics which seemed to determine financial statement preparation.

As farmers become more dependent on operating credit, as evidenced by a greater percentage of operating funds being borrowed, they are more likely to prepare both balance sheets and pro-forma cash-flow statements. The preparation of pro-forma cash-flow statements increases at a faster rate than balance sheets as a farm's relative use of operating credit increases. One could speculate that the lender group may influence the positive relationship between preparing financial statements and using operating credit.

Business size, expressed in acres, has a positive relationship with the preparation of financial statements. This might be explained by the need for greater management control in larger operations.

Older farmers were less likely to prepare financial statements. Conversely, younger farmers were more likely to prepare financial statements. This relationship probably reflects both a greater need for more formal financial planning by younger farmers, possibly because of high credit usage, as well as a greater capability to prepare and use financial information.

Table 2—Financial statement preparation and selected characteristics of farmers

Factor	Farmer respondents	Respondents preparing: Balance sheet	Respondents preparing: Pro-forma cash flow
	Number	*— — — Percentage — — —*	
Percent of operating funds borrowed:			
0-25	186	60	36
26-50	46	80	48
51-75	27	82	70
76-100	34	91	88
All groups	293	69	48
Farm size (acres):			
0-450	141	58	36
451-950	110	75	54
951-above	42	86	64
All sizes	293	69	48
Respondents' age (years):			
0-39	92	77	61
40-59	144	65	42
60-older	57	61	35
All ages	293	69	48

Lender Responses

As evidenced by the responses of the surveyed farmers, lending institutions exert considerable influence on their borrowers to generate financial information. At the same time the farmer survey was conducted, agricultural lenders in Illinois were surveyed. Twenty-five randomly selected banks in each of the State's four regions were sent questionnaires. Twelve Production Credit Association officers and 12 Federal land bank lenders were also surveyed. Sixty-eight usable responses were obtained from the 124 institutions surveyed.

Lenders responded as to both their own and their farmer clients' needs for financial information. Fifty percent of the lenders responding felt that their farmer clients need additional records to make better business decisions. Cash-flow records were most often cited as useful additional financing information for farmers.

With respect to their own information needs, 70 percent of the respondents indicated that sufficient records were available for the lender to make decisions. Balance sheets are essential from the lender's viewpoint. Over 90 percent required balance sheets for farm loans of more than $5,000.

Lenders' requests for a pro-forma cash flow were less uniform. Almost one-third of the lender respondents never require a cash-flow projection from a farm borrower. The remaining two-thirds would require a pro-forma cash flow i a farm borrower was having difficulty servicing present deb commitments or was attempting to finance an expansion of the farm business.

As farms become larger and more complex, a need may aris for financial statements which are verified by an external party. An audit is essentially a verification of the accuracy the data presented in financial statements. The lenders were asked if they foresaw that audited financial statements wou be required of their farm borrowers. Over 70 percent indicated that selected borrowers would need to provide audite statements within the next 5 years. Audited financial statements were expected to be required of corporations, partne ships, and large sole proprietorships. Audit procedures require that relatively rigid standards be met by the farm accounting system if an "unqualified opinion" is to be offered by the auditor. Therefore, farmers facing audit requirements may be forced to adopt more rigorous accounting systems.

ounting Practices and Procedures Used

use the adequacy of farmer record systems is likely to
me an increasingly important issue, a survey was con-
ed to learn what accounting practices and procedures
urrently in use. In December 1980, a survey was sent to
dministrative officials in charge of operating record
ems. Eleven of the surveyed systems had ties with land
t universities and the other system was affiliated with
Farm Credit System.[2] All 12 systems participated in the
ey.

s of Accounting for Surveyed Systems

survey determined how net income was calculated by
rent record systems. To properly understand what
mation a system's reports are providing, a clear under-
ding of a system's definition of net income is required.
distinct methods of reporting net income are com-
. One method reports net income as the difference be-
n cash revenue and cash expenses less depreciation,
the other method reports net income as the residual
ining when accrued expenses are subtracted from
ued revenues. The underlying difference between the two
ods is that the cash system primarily recognizes reve-
and expenses when cash transactions occur; the accrual
em recognizes revenues and expenses as they are pro-
d or incurred. An accrual system more accurately
cts the actual operations of a business, but it is more
plex and difficult to administer than a cash system.

ever, the primary system used is a hybrid method
bining the simplicity of a cash method with the superior
rting capabilities of the accrual method. Eleven of the
urveyed systems used a cash system with accrual adjust-
ts (change in inventories, change in accrued expenses)
n reporting the net income of a business. No system used
h basis for reporting income while one surveyed system
cated that a pure accrual basis was used for deriving net
me. It seems that record systems officials are attempting
eep their systems relatively uncomplicated by using a
system as a basis for recording transaction data, but at the same time are attempting to provide accurate measures of financial progress by converting to an estimate of accrual data.

Reports Provided by the Systems

The survey considered five important reports prepared by a high percentage of the record systems surveyed (table 3). The last frequently prepared report compares actual cash-flow results with those budgeted at the inception of the reporting period. Without comparing actual to budgeted cash flows, however, it is difficult to determine whether financial goals are being met. Four of the surveyed systems did not offer this report. Of the eight systems offering the cash-flow comparison, six indicated that the farmer is responsible for preparing this report. Based on the lender's response to the previous survey, this may be an area where farm operators need further assistance.

Frequency of Report Preparation

Most of the financial reports in this study are prepared on an annual basis (table 4). Although an annual report may be appropriate for balance sheets and income statements, it is not as appropriate for monitoring cash flows. Managers who only receive annual reports may find it difficult to anticipate or detect short-term budget deviations. Monthly or quarterly reports concerning cash receipts and cash expenditures would allow farmers to evaluate short-term performance and possibly aid in detecting problem areas within the business. Early detection and correction of deficiencies within a business are critical, especially in the low-price/high-cost conditions which currently exist in agriculture.

Methods of Valuing Selected Assets

Assets must be assigned values when a balance sheet is prepared. In the nonagricultural sector of the economy, most assets would be assigned a value which represented the lower of either the cost of the asset or the market value of the asset. The cost of an asset may represent the original purchase price of the asset, the original price of the asset less accumulated depreciation, or the summation of the costs of materials and services which were used in producing that asset.

However, there are instances when it may be difficult to determine an agricultural asset's exact cost. Examples of such assets are marketable commodities or real estate. Thus market values may be assigned to some farm assets when nonagricultural accountants might prefer cost values. If some agricultural accounting systems are strictly adhering to generally accepted accounting principles (GAAP) while others are not, confusion could prevail as to the meaning of balance sheet comparisons.

The specific land grant institutions contacted were:
ersity of Illinois, University of Kentucky, Iowa State
ersity, Kansas State University, University of Arizona,
ersity of Minnesota, University of Nebraska, Oklahoma
e University, University of Wisconsin, Auburn University,
University of Georgia. The names of the institutions
acted were primarily obtained from the membership
ctory of the National Association of Farm Business
lysis Specialists. Some systems cited are decedents of
r record systems but each accounting package may be
inistered differently. Hence duplication bias was not
idered a problem since the primary concern was with
t accounting services were available to farmers.

Table 3—Number of farm record systems generating selected reports and generating method used[1]

Report	Not generated	Manually generated		Computer generated	Oth
		By farmer	By bookkeeper		
		Number			
Cash flow for total operations	1	5	1	4	1
Comparison of actual cash flow with budgeted cash flow	4	6	1	1	0
Accrual basis income statement	0	1	1	10	0
Balance sheet	0	2	1	9	0
Comparisons of operations with respect to:					
Production	2	0	1	9	0
Costs	2	0	1	9	0
Profitability	2	0	1	9	0

[1] Survey based on responses of 12 administrative officials in charge of operating record systems.

Table 4—Frequency of generating selected reports[1]

Report	Monthly	Annually	Other (on request)
		Number	
Cash flow for total operation	4	6	1
Comparison of actual cash flow with budgeted cash flow	2	3	3
Accrual basis income statement	2	9	1
Balance sheet	2	9	1
Comparisons of operations with respect to:			
Production	0	10	0
Costs	0	10	0
Profitability	0	10	0

[1] Survey based on responses of 12 administrative officials in charge of operating record systems.

The valuation methods currently being employed are presented in table 5. The surveyed systems appear to force the participants to conform with specified guidelines, as exhibited by the relatively low percentage of responses in the "Other" category. Thus, record systems are creating more

Table 5—Method of asset valuation for selected assets[1]

Asset	Valuation method		
	Market value[2]	Cost[3]	Oth
	Number		
Grain and feed inventory	9	0	3
Marketable livestock	10	0	2
Breeding livestock	8	1	3
Machinery and equipment	4	6	2
Land	8	1	3
Buildings and improvements	5	5	2

[1] Survey based on responses of 12 administrative officials charge of operating record systems.

[2] Refers to the fair market value of an asset.

[3] Refers to purchase price or cost of production.

[4] Refers to recordkeepers assigning an asset with any value t desire.

ormity in that they specify a method to be used by their cipants for valuing assets.

grain, marketable livestock, and breeding livestock, the eyed systems seem to agree that the market value is an opriate means for valuation. However, agreement be- n the systems was not as evident when capital assets considered. For machinery and equipment, the cost ap- ch was the dominant method used. For buildings and ovements, however, market vaue was used just as fre- ntly as the cost basis. In contrast to these two asset s, land was most frequently valued at its fair market e. Of course, fair market value of land is itself a difficult ept to define, especially in a system with several indi- als responsible for assessing land values.

clusions

areas of agricultural accounting most likely to experi- change concern timely cash-flow reports, potential ts of the accounting systems used by farmers, and ormity of accounting practices.

nges in cash-flow reporting are likely in two areas. First, ers could increase their use of pro-forma cash flows for purpose of analyzing potential farm plans as well as for fying lender information requirements. Second, these rts may need to be prepared in a more timely manner the annual reports provided to farmers by existing rd systems.

ders were found to exhibit considerable influence on ther farmers generated financial reports. Therefore, cultural accounting systems beneficial to farmers must accommodate the needs of the lending industry. Because lenders foresee a need for some farmers to provide audited financial statements in the near future, it appears that some agricultural accounting systems will need audit capabilities. Also, the IRS sometimes wishes to verify the accuracy of the data it receives from a farmer; therefore, audit pressures also could come from this source.

A move toward uniformity of accounting practices within the agricultural accounting profession complements development of accounting systems which may be audited. An audit includes a statement to the effect that the financial reports in question "have been prepared in accordance with generally accepted accounting principles." Thus, before an audit may be performed a set of principles must be developed, accepted, and applied by the profession. Through the adherence to a set of well-defined principles, uniformity within the agricultural accounting profession will result.

Agricultural accounting is a valuable activity of the farmer. Accounting helps the farmer review business performance, obtain necessary credit, and comply with the informational requirements of external institutions. Given the importance of accounting, it seems proper that the agricultural accounting profession try to anticipate farmers' needs.

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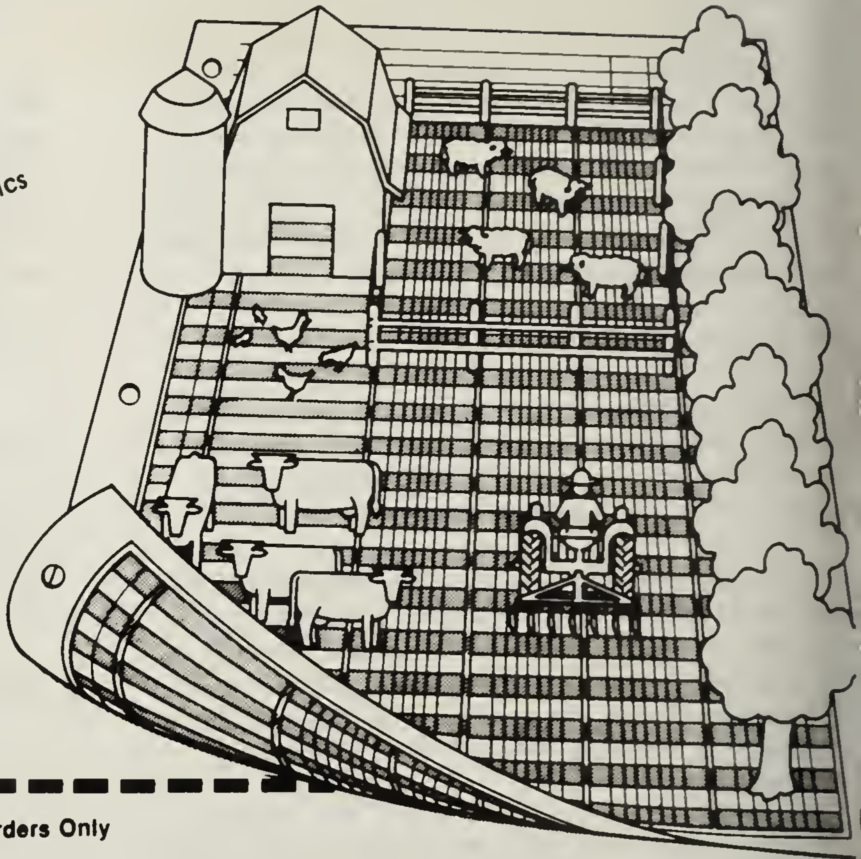

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AGRICULTURAL FINANCE REVIEW, Department of Agricultural Economics,
Cornell University Volume 43

PREFACE

Agricultural Finance Review provides a forum for presentation of research and discussion of issues in agricultural finance. Publication is annual, and all articles are contributed by scholars in the field. Articles on assigned topics may occasionally be commissioned from specific authors.

Volume 43 is the first to be published at Cornell University. The previous forty-two volumes were published by the United States Department of Agriculture. *AFR* was begun in 1938 by Norman J. Wall and Fred L. Garlock, whose professional careers shaped much of agricultural finance research for many years. Since that time, professional interest in agricultural finance has continued to grow, involving larger numbers of people and a greater diversity in research topics, methods of analysis, and degree of sophistication. We are pleased to be a part of that continuing effort.

The effectiveness of this publication as a means of promoting agricultural finance research and discussion depends on its support by the profession. We have been pleased by the response in our first year. Thirteen manuscripts were submitted from which the six herein wer selected for publication. We thank all those who submitted manuscripts.

We wish to express our sincere thanks to those who contributed their valuable time to review submissions for us:

Bruce L. Anderson
Timothy G. Baker
Peter Barry
Gary Benjamin
William N. Capener
Hoy Carmen
Francis Epplin
Stephen Gabriel
William Hardy
Duane Harris
Glenn Helmers
William Herr
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James Plaxico
Lindon Robison
Lee F. Schrader
Jerry Thompson
Richard Trimble
Alan Tubbs

Finally, we invite your suggestions for making improvements in *Agricultural Finance Review.* Manuscripts for the 1984 issue must be received by February 1, 1984. Manuscripts will be accepted at any time, however, and those received after February 1 will be considered for the 1985 issue.

John R. Brake, Editor
Eddy L. LaDue, Associate Editor
Loren Tauer, Associate Editor

he Impacts of Recent Changes
n Personal Income and Business
rofit Taxes on Investments in
he Farming Sector

ean W. Hughes and Ann Laing Adair

bstract

he Economic Recovery Tax Act changed e U.S. tax structure to stimulate investent. Amendments to the act reversed some these changes but preserved the original tent. The purpose of this article is to anaze the impacts of these tax laws on investents in the farming sector. Although the ost obvious impact of decreasing tax rates n income and profits is to encourage vestment, when the effects of these hanges on government deficits and investents in other sectors are included, farmers re shown to have less incentive to invest eir businesses than they would have withut the tax cuts.

ey words: farm investment, farm taxes, RTA, TEFRA, general equilibrium model, ost of capital.

Significant changes in the personal income and business tax laws were made with the passage of the Economic Recovery Tax Act of 1981 (ERTA) and the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). Several articles have dealt with the implications of these changes for individual farmers or for the output of specific commodities (Nixon and Richardson; Boehlje and Carman; Lybecker; Harl; and Durst, Rome, and Hrubovcek). None, however, has described the aggregate impact of the changes in the tax laws on farm investments or the dramatic impacts of these changes on the funding requirements of the government and subsequent feedback effects on agriculture.

The purpose of this article is to examine, within the framework of a general equilibrium model, the effects of some of the major provisions of ERTA and TEFRA on sector-level investment decisions. The first section will briefly describe the changes in the tax laws that are being considered in the rest of the paper. The linkages between agriculture and the general economy, which help to determine how farm sector investments are influenced by changes in the tax laws, are presented in the second section. Comparisons of the results of counterfactual simulation of the economy both with and without ERTA and TEFRA are made in the third section. The final section provides a brief statement of the conclusions of this work.

Tax Law Changes

The Economic Recovery Tax Act of 1981 was passed into law in order to stimulate investment and growth in the economy through a

---

ean W. Hughes is an associate professor of agricultural economics at Texas Tech University. Ann Laing dair is a research assistant at Texas A&M University. he research for this project was done while both uthors were employed at the Federal Reserve Bank of ansas City. The views expressed herein are solely hose of the authors and do not necessarily represent he views of any of the institutions associated with the roject.

series of tax reductions to increase investment incentives to businesses and saving incentives to consumers. Businesses benefit through reductions in individual and corporate income taxes, as well as accelerated cost recovery on capital items. Consumers benefit through lower income taxes and might gain eventual relief from inflation as higher business investment stimulates production of more goods at a lower cost. Some of the major provisions of the new tax laws that are analyzed in later sections of this article are described here.[1]

Farmers benefit under ERTA from reductions in personal income tax rates because the majority of farms are still sole proprietorships or partnerships. The cumulative annual impacts of these changes are reductions in personal tax rates of 1.25 percent in 1981, 10 percent in 1982, 19 percent in 1983, and 23 percent in 1984.

Possibly the most significant changes in the tax laws affecting farms as businesses relate to deductions for capital expenditures. The old depreciation system has been replaced with the Accelerated Cost Recovery System (ACRS), which eliminates the need to determine a useful life, depreciation method, and salvage value of an asset. The ACRS method is based on four classes of recovery property, 3-year, 5-year, 10-year property, and 15-year real property. Although the recovery periods for some assets remain unchanged, most items have a substantially shorter recovery period under the ACRS, thereby allowing a faster tax write-off and full depreciation of property by the end of its taxable service life. Most agricultural equipment and single-purpose agricultural structures will have a 5-year recovery period rather than their previous 10-year and 25-year useful lives.[2]

On August 20, 1982, the tax laws were changed again when the ERTA was amended by the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). This act left the 1981 reductions in personal income tax rates unchanged, although it offset some of the declines in income tax liabilities by imposing withholding on interest and dividend income, increasing interest rates on unpaid taxes, and generating increased Treasury revenue in other ways (Harl). The 1982 act also left the accelerated cost recovery system unchanged until 1985.

Investment in Agriculture and Fiscal Policy

This section briefly reviews the main features of the specifications of the capital asset demand equations used in later analysis and identifies the important factors that lead producers to expand or contract the use of capital assets in farm production. A discussion of how recent changes in the ta laws affect these factors is also included.

There are many ways to explain investment behavior, but perhaps the most straightforward is the classical approach described b Lamm or by Hughes and Weimer. Traditiona production economics suggests that net investment is undertaken whenever the existing level of capital assets is less than optimal—the level required to equate the marginal value product of capital to its marginal factor cost.

The driving forces behind investment are, therefore, the determinants of the marginal value product and marginal factor cost of capital. Four factors determine the margina value product of capital: the amount of cap tal used, the price of output, the desired quantity of output, and the amounts of othe inputs used in production. Marginal value product declines if more capital is used, holding all else constant. Thus if the marginal value product exceeds the marginal factor cost, producers move toward equilibrium by increasing the capital stock. Shifts occur in the demand for capital, if any of th other factors change. With an increase in the price or the desired level of output, the marginal value product of capital rises and more capital is demanded at any marginal factor cost. The influence of changes in the levels of other inputs is not determinant an ries depending on whether or not the ner inputs are complements or substitutes r capital.

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[1] For a more complete listing and interpretation of ERTA's provisions relating to agriculture see Durst, Rome, and Hrubovcek.

[2] ERTA also provided substantial incentives to increase lease financing. Many of the incentives were reduced or eliminated with the passage of TEFRA, and insufficient data exist to track the impacts of leasing on the farm sector (Adair, Penson, and Duncan). Thus although leasing is potentially important, it is not included in this analysis.

efining the marginal factor cost of capital) is still a subject of debate but is gener- y considered to include the price of a unit capital, the level of interest rates, the vel of tax rates applicable to purchasing or ing capital, the time pattern for depreciat- g the capital for tax purposes, and the ne pattern of physical deterioration of the rvices the capital asset provides.[3] C creases if the price of capital, interest tes, income tax rates, or rates of physical terioration rise. C declines if the invest- ent tax credit rate increases or the asset is owed to be depreciated more quickly for x purposes.

n analysis of how the recent changes in the x laws will affect investment in the farming ctor should, therefore, consider the influ- ice of fiscal policy on the price and quan- y of farm output, the price of capital, and e level of interest rates, as well as the rect influence of lowering tax rates.

ne most obvious effect of the tax cuts on vestment in agriculture is to reduce the arginal factor cost of capital directly. The ll impact of the tax-induced investment imulus will not be realized, however. All her businesses face the same stimulus nd try to expand. To do so, they need to orrow, and interest rates rise, offsetting to ome extent the tax-induced decline in the arginal factor cost. Given any substitutabil- in manufacturing machinery for farm and onfarm use, additional investment demand the nonfarm sectors will also increase the ice of farm equipment to some extent.

ess direct but perhaps more important are e impacts the tax cuts will have on the eneral economy by increasing government eficits. Some projections of the 1984 deficit e greater than $200 billion (U.S. Office of anagement and Budget) and equal more an half of private savings. The political rocess has and will probably continue to generate compromises to reduce government expenditures and increase taxes. The deficit, however, will probably continue to be large, although perhaps less than some forecasters project.

Compromises that include reductions in government spending will have both direct and indirect effects on agriculture. Agricultural policy prescriptions that continue to minimize budget exposure such as the current Payment in Kind program can be expected. Thus over time government support of farm incomes may diminish. Slower growth in domestic incomes because of reduced government spending would also have an effect on farmers. Although this effect is less direct, its magnitude is potentially greater than the effects of the more visible farm program decisions, given the growing dependence of agriculture on general economic conditions.

Large government deficits will probably keep real interest rates high.[4] Since the government deficit must be financed with either bonds or money, continuing deficits with controlled growth in the money supply imply greater government borrowing and increased real interest rates. Any stimulus to investment that might be expected from cutting tax rates will, therefore, likely be offset to some extent by higher real interest rates.[5]

Income also plays an important role in farmers' investment decisions, and increased government borrowing will likely reduce farm income. Higher real interest rates increase the costs of production and lower

---

ee Branson; Coen; Penson, Romain, and Hughes; and erimias for different developments of the marginal actor cost of capital. Jerimias's derivation is recom- mended because it is the most complete specification of the factors included in the investment decision.

[4] Deficits almost always increase interest rates above what they would be with a balanced budget. During recessions, however, part of the deficit is an automatic response to lower economic activity, and declines in private demands for funds can offset the growing demands by the government. Thus the full employment deficit is a more appropriate measure of the likely impacts of fiscal policy on interest rates. The full employment budget is projected to be in deficit by as much as $90 billion in 1984.

[5] These effects of higher real interest rates are not unique to farming, and they point out the distributional consequences of different macroeconomic policies in achieving similar goals. Clearly, investments are skewed away from all interest sensitive sectors such as construction and automobile manufacturing in periods of high real interest rates.

prices received by farmers over the short-to-intermediate term.[6] With farm debt at about $200 billion, a one percentage point increase in interest rates adds about $2 billion to production expenses. On the receipts side, farm-level prices are also sensitive to changes in real interest rates (Schuh; Scherr and Madsen). Since most purchasers of farm products must hold them as inventories, higher interest rates tend to depress the prices offered to farmers. High real interest rates also slow general economic activity and increase the foreign exchange value of the dollar, further reducing both the demand for farm products and prices received by farmers. Both simulation results using the GEM model and reduced form estimates of farm price equations show the elasticity of constant dollar farm prices to changes in real interest rates to be about 0.15.[7] Given 1982 levels of interest rates, farm prices, and incomes this translates into a decline in farm revenues of about $2 billion for each one percentage point increase in interest rates.[8]

Timing and Size of Probable Impacts

Several countervailing forces that have an impact on farm sector investment emanate from the recent changes in the tax laws. The direct effect of reducing tax rates on income and capital is to lower the marginal cost of capital and stimulate investment. Offsetting the direct effects of the tax cuts are increases in the prices of capital assets and the impacts of higher interest rates on the marginal cost of capital and farm income.

The reaction of agriculture to changes in the tax laws is, therefore, an empirical question. At the very least, the magnitude of the influences of each of the linkages outlined above is needed to address the question posed in this research. This section describes the econometric model used to stimulate the economy over the 1982-84 period, both with and without the tax cuts. It also includes a discussion of the assumptions underlying the two scenarios and the results of running such an experiment.

The Model

The model used in this research is the GEM model developed by the U.S. Department of Agriculture (USDA) (Hughes and Penson 1980) and has been used by the USDA and others for both forecasting and evaluating financial implications of macroeconomic policies (Hughes 1979, 1981a, 1981b; Hughes, Gabriel, et al.; Duncan, Hughes, and McDonley; Hughes and Penson 1981). GEM, an acronym for general equilibrium model, incorporates equations covering all the goods in the economy. GEM is a macroeconomic model but differs from most other models of the economy in two important aspects: (1) it focuses on agriculture, providing detailed reports of the major financia accounts of the sector, and (2) it accounts for the flows of both goods and services—the principal building blocks of other macroeconomic models—and the stocks of wealth of each endogenous sector.

The model factors the economy into six sectors: farm operator families, other domestic consumers, nonfarm producers, financial intermediaries, the government, and the res of the world. Farm operator families is the sector with the most detail. It has two explicit production functions, one for crops and e for livestock. Both the demands for puts and the supplies of outputs are deter- ned simultaneously. In addition, farm erator families' economic decisions are ndled in a way that recognizes that they e both producers and consumers. Thus e model captures trade-offs within the m sector among consumption, invest- ent, and saving.

---

[6] Over the very long run, reductions in farm output in reaction to higher costs would eventually cause returns on farm assets to increase in order to be competitive with other investments. In the short-to-intermediate term, however, farmers will continue to produce as long as they cover variable costs and are making some contribution to fixed costs. The long-run adjustment occurs when lenders are unsatisfied with the partial payment to debt and they force exits from the sector. Even then, only marginal farmland leaves production. Thus quantity adjustments in agricultural production take many years and are probably of little importance in a world of substantial swings in short-run policies.

[7] Both the GEM model (Hughes and Penson 1980) and reduced form estimates of quarterly prices received generate substantially the same result. The GEM model was run with real interest rates increased by 10 percent above their simulated values for 1982, approximately one percentage point. The result was a decline in prices received by about 1.5 percent. The reduced form equations regressed prices received for livestock and crops as functions of real interest rates and other variables. Elasticities calculated from the reduced form equations confirmed the results of the model runs.

[8] Given an elasticity of prices received to real interest rates $[(dP/dr)(r/P)]$ of .15, an index of constant dollar farm prices of about 1.0, and real interest rates about 0.10, the change in farm prices for one unit change in the real interest rate is 1.5. If the interest rate increases by one percentage point, the prices received index declines by .015. Assuming there is no short-run quantity adjustment, the impact of a one percentage point increase in interest rates is to decrease farm revenues by 1.5 percent. With farm revenues about $140 billion, this works out to be about a $2 billion decline in farm income for each percentage point increase in real interest rates.

the GEM model, particular attention is ven to developing capital input demand uations. Costs of capital are used to count for many of the recent changes in e tax laws. These costs are also linked to al interest rates, farm income, and prices nonagricultural durable inputs also lved for in the model.

ssumptions Made in Comparing ivestment with and without Tax Cuts

with all econometric models, GEM quires projections of exogenous informa- on to simulate endogenous variables, and with most counterfactual analyses, a seline or "most likely" run of the model derlies the comparisons. Without dealing th the specific levels of each of GEM's 60 ogenous variables, it is possible to scribe the basic premises of the baseline.

ssumed fiscal policy incorporates the per- nal and business tax rate reductions assed as part of the Economic Recovery x Act of 1981. Personal tax rates for farm perator families and other domestic con- umers are decreased by 10 percent in 1982, 9 percent in 1983, and 23 percent in 1984. usiness taxes are reduced $3.6 billion in 982, $6.0 billion in 1983, and $9.5 billion in 984 to reflect the accelerated cost recovery rovisions of the 1981 act (Condrell). Tax epreciation rates used in calculating costs f capital are also adjusted to account for e service lives allowed under the new law. ome slowing of the rate of increase in gov- rnment expenditures is assumed. Although eficits increase, they do not grow to more han $200 billion but are only $130 billion in 984. Consistent with slower growth in gov- rnment expenditures, continued reductions f government support of agriculture are uilt into the baseline. Included are con- tant real dollar target prices and continued eductions in purchases of food for school unch programs, food stamps, and aid to the lderly through 1984.

Monetary policy is assumed to continue to constrain growth in monetary aggregates, which results in a rapid decline in inflation. Growth in foreign economies is assumed to be slower than in the recent past, increasing only 3 percent per year compared with over 4 percent annually during the 1970s. Finally, no supply shocks are anticipated. Neither unusual weather patterns generating agricultural shocks nor large increases or decreases in the price of imported fuel are assumed.

Aggregate Baseline Results

The baseline assumptions generate projections of slow economic growth.[9] The average annual growth in real gross national product is 2.8 percent for 1982 through 1984. Real interest rates remain high, with the average real rate on Treasury bills at 6.6 percent through the period. Nominal rates, however, are projected to come down as a result of disinflation. Inflation, as measured by the GNP deflator, declines to 5.6 percent in 1984 after peaking at 9.1 percent in 1981.

In the baseline, net farm income is projected to be very low in 1982 but to start to grow in 1983 and to be reasonably high in 1984.[10] The relatively low net farm incomes coupled with extremely high real interest rates generate projections of farm investment in machinery and motor vehicles and real estate improvements for 1982 through 1984 that are lower than in the preceding three years in both current and constant dollars. No large increases in agricultural investment are, therefore, projected even with the implementation of the tax cuts.

This is not the answer to the question posed in this research, however. Projections of slower investment in the farm sector in 1980–84 could have any number of causes. Another model run is required, differing only in the assumptions regarding the exogenous variables directly affected by the tax law changes. Comparisons of the results of the two model runs then identify changes in farm sector investment caused by changes in the tax laws.

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[9] For a more complete listing see the baseline results reported in Duncan, Hughes, and McDonley.

[10] In constant dollars, the projected net farm income for 1984 is still $2 billion lower than net farm income in 1979.

Table 1. Impacts of 1981 and 1982 Tax Law Changes on Selected Macroeconomic and Farm Sector Variables

Variable	Percent Change between Model Results with and without Tax Law Changes[a]		
	1982	1983	1984
Real GNP	−0.8	0.5	1.1
Real Treasury bill interest rate	7.0	34.8	49.7[b]
Prices of machinery and motor vehicles	0.1	1.1	1.9
Cost of capital	1.1	7.7	14.8
Prices received for crops	−1.6	−2.0	−0.7
Prices received for livestock	−0.4	0.0	2.5
Gross farm receipts	−1.0	−1.0	0.8
Farm production expenses	1.6	2.1	3.6
Net farm income	−21.9	−17.1	−10.9
Capital stock of machinery and motor vehicles			
Value	0.1	1.0	1.4
Capacity	0.0	−0.2	−0.5
Gross investment in machinery and motor vehicles			
Value	0.3	−0.3	1.0
Quantity	0.2	−1.4	−0.9

[a] Results reported in percentages and developed by dividing outcomes assuming tax cuts by outcomes assuming no tax cuts. All variables are in constant dollars.

[b] Percentage changes on low base numbers can be deceiving. The 49.7 percent change represents a difference between the results of less than two percentage points.

Removing the tax cuts changes some exogenous variables. Government deficits decline to only $25 billion in 1984, which allows the assumed monetary policy to be less restrictive and still achieve the same level of inflation in 1984 as in the baseline.[11]

The Impact of the Tax Cuts on Agricultural Investment

Table 1 shows the results of comparing the two model runs for selected macroeconomic and farm sector variables for 1982 through 1984. Effects of changes in the tax law on farm investment in machinery and motor vehicles are emphasized, because these investments account for more than half of total farm investment. Each of the determinants of investment discussed in previous sections is listed.

As might be expected, real interest rates are projected to be substantially higher given the tax cuts. Slower growth in real gross national product might be expected with higher interest rates but does not occur in all years. The tax cuts reduce growth in 1982, but growth is greater with the tax cuts in 1983 and 1984. Basically, the stimulus given the economy in 1982 by tax reductions is not large enough to overcome the drag of high real interest rates. By 1983, the cumulative stimulus of the tax cuts overrides the impact of higher interest rates, and gross national product grows faster with implementation of the ERTA and TEFRA.

Prices received by farmers show mixed results. The higher interest rates in the tax cut scenario generate lower farm prices in 1982. In 1983 and 1984, however, prices received for livestock in the tax cut scenario surpass those in the no tax cut scenario, and prices received for crops continue to lag behind. This difference in behavior occurs because livestock prices are more sensitive than crop prices to the rate of economic growth in the model. Since GNP grows faster in the tax cut scenario, livestock prices eventually overcome the negative influence of higher interest rates and rpass prices in the no tax cut scenario. ith the tax rate cuts and higher real inter- st rates, gross farm receipts are lower in 82 and 1983 than if the tax laws had not een changed. Even though gross farm ceipts increase in 1984, the increase is sufficient to overcome increases in pro- uction expenditures in all three years. Net rm income, therefore, is lower in all three ears, given the tax cuts.

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[11] A "less restrictive" monetary policy in the GEM model is somewhat different from the commonly accepted definition. The GEM model excludes the money market rather than the bond market by using Walras's Law and the government budget constraint. Thus monetary policy is measured by growth in the stock of government bonds held by the public, not the growth in the money supply. Given a lower government deficit, a constant growth in the money supply implies slower growth in government bonds—a "less restrictive monetary policy."

he tax stimulus to investment in all sectors creases the price of capital inputs to the rm sector. This effect, coupled with higher terest rates, overwhelms the impact of wer taxes, producing a higher cost of capi- l. With a higher cost of capital and lower comes, the optimal capital stock in farm- g declines. The result is a smaller quantity f net investment. While higher prices for apital inputs increase the value of gross vestment and the value of the capital ock, the quantity of machinery and motor ehicles in farming decreases with the 1981 nd 1982 tax cuts.

ummary and Conclusions

he Economic Recovery Tax Act of 1981 and ubsequent amendments posted in the Tax quity and Fiscal Responsibility Act of 1982 ave changed many of the economic incen- ves of farmers, other businesses, and con- umers. Farmers and other consumers that ay income taxes will have lower tax rates very year until 1984. Businesses can ecover their cost of investment more rap- dly and therefore have a greater incentive to urchase capital inputs.

nalyzed separately, these changes in the ax laws should provide farmers with rea- ons to increase their capital stock. Such a artial analysis can be misleading, however. hen all the effects of changes in the tax aws are traced through the government def- cit and actions of other sectors, instead of eing encouraged to increase investment, armers may have the incentive to reduce nvestment.

The tax law changes will increase the incen- ive for all businesses to invest, which in urn will probably lead to increases in both the price of durable inputs and interest rates. These changes in the tax laws are also generating large government deficits that increase interest rates even further. Given the interest rate sensitivity of net farm income and the effects of higher interest rates and higher prices of durable inputs on the cost of capital, lower tax rates introduced in ERTA may reduce the optimal agricultural capital stock below what might have existed with the old tax laws. Actual quantities of capital follow the optimal level downward, even though the value of the capital stock may be held high by price increases. Thus the farming sector may be one of many sectors that show a perverse reaction to the policy of using general tax reductions to encourage investment.

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Evaluation of State Legislative Programs to Assist Beginning Farmers

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bstract

ince the mid-1970s interest has grown in tate programs to aid beginning farmers. tate legislation is characterized by three pproaches: direct loan programs based on ax-exempt bonds, loan guarantee programs, and tax incentives for landowners who sell or lease their land to beginning armers. Most state programs focus on subsidizing real estate purchases. The public ost of the approaches differs substantially. The bond-based direct loan approach is the ighest cost method now used in the United tates. Relatively low-cost options include ax incentives for landowners who lease and to beginning farmers and matching grants for savings toward a farm purchase by prospective farmers.

Key words: Beginning farmers, loan guarantees, tax incentives, tax expenditures, land banking.

Between 1976 and 1981 many state legislatures debated and implemented programs to aid beginning farmers by subsidizing credit or giving tax incentives to landowners to sell or lease their land to young farmers. State interest in programs for beginning farmers was a response to a public perception that starting a family farm was becoming increasingly difficult and that federal programs such as those of the Farmers Home Administration were not doing enough to aid entry. Although research has identified a wide range of problems faced by beginning farmers, including risk and rising managerial requirements (Boehlje and Thomas, pp. 21–23), most of the legislative activity and public debate on programs to aid young farmers has centered on helping entrants gain control of the physical resources necessary to begin farming (U.S. House of Representatives, "Beginning Farmer Assistance Act Hearings," and U.S. Senate, "Hearings on the Young Farmers Homestead Act"). This article describes state programs for beginning farmers as they existed in 1982 and evaluates the cost-effectiveness of state options for reducing resource control barriers to entry.

Barriers to Entry

Compared to many other American industries, agriculture has few barriers to entry. There are no licensing requirements, and capital levels are relatively modest. Unlike people who seek careers in most other industries, however, farmers are expected to provide both their labor and a substantial amount of capital. As labor became a smaller portion of the total farm inputs and

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capital a larger portion, it became clear that the low-net-worth entrant was at an increasing disadvantage and the family farm system, in which a person provides both labor and capital for the farm business, was threatened. Public debate has focused on the barrier resulting from the high cost of farm real estate (U.S. House of Representatives, "Beginning Farmer Assistance Act Hearings," and U.S. Senate, "Hearing on the Young Farmers Homestead Act").

Recent studies of barriers to entry have confirmed the importance of managerial ability, risk-bearing capacity, and control of physical resources, and some studies have questioned whether increasing capital requirements are the primary barrier to entry. In a study of the opportunities for young farmers in southern Minnesota, Thomas and Jensen found that the prospects for superior managers were bright, but the average manager was likely to face a future of low income and financial difficulty. From an analysis of census data in the mid-1970s, LaDue (a) found that the chances of a prospective farmer finding the resources needed to enter had declined. Kaiser's study of financial strategies used by beginning farmers suggests that risk is an important factor in limiting entry options.

Although the increased use of capital is obvious to anyone familiar with U.S. agriculture, the importance of that increase for beginning farmers is less clear. Entry-level capital requirements may not have grown as much as average capital use. In a study of young PCA borrowers, Herr and Obrecht found entry-level capital is often far less than the average capital per farm. In a study of conditions faced by entering farmers between 1945 and 1977, LaDue (a) found that although capital accumulation before entry was difficult throughout the period, liberalization of credit terms had tended to offset the increase in capital requirements. Lowenberg-DeBoer analyzed data from young farmers' records in 1910, 1930, 1950, and 1978 and found that those who started as tenants may have had more trouble gaining control of capital, but for those who started as owner-operators the hypothesis of increasing difficulty over time was not supported. Both LaDue and Lowenberg-DeBoer found that repayment capacity after entry had not deteriorated over time.

State Legislation

State programs with direct implications for entry into farming have been legislated in Minnesota, Louisiana, Texas, North Dakota, Iowa, Georgia, and Indiana. These programs differ in their commitments to beginning farmers. Legislation in Iowa, Minnesota, Texas, and North Dakota is narrowly focused on beginning farmers, whereas that in Louisiana, Georgia, and Indiana includes a broader eligibility group. Programs in these seven states should be distinguished from two other groups of state agricultural credit programs: (1) the general farm credit programs that have been legislated in Alabama, Nebraska, Arkansas, Tennessee, Virginia, South Carolina, and Colorado, and are funded through revenue bonds, and (2) the older farm credit programs funded from income from rental and mineral royalties on state lands, such as the Wyoming Farm Loan Board and the farm loan program of the Oklahoma Commissioners of Land Office. The programs in both of these latter groups may benefit beginning farmers, but the legislation on which they are based does not explicitly mention such an aim, nor do the eligibility standards indicate concentration on those entering farming.

Minnesota: The oldest of the state programs for beginning farmers is the Minnesota Family Farm Security Program enacted in 1976 (*Minnesota Statutes Annotated*). The program guarantees real estate loans, subsidizes interest payments, and exempts interest on seller-sponsored loans from state income taxes. The guarantee indemnifies the lender for 90 percent of the loss of principal and interest in case of a default. The guarantee is backed by a $10 million fund, which according to program officials can secure $100 million in loans. As of the end of 1981, some 318 loans with a total value o $56 million had been guaranteed. The interest subsidy is accomplished through an interest payment adjustment of 4 percent, which is available if the maturity date of the loan is within 20 years. If, for example, the interest rate is 12 percent, the effective rate for the applicant becomes 8 percent with the balance being paid out of the state treasury. The payment adjustment must be repaid without interest in a balloon paymen at the end of the repayment period, so the actual subsidy is the interest-free use of ate money during the adjustment period. ne payment adjustment can be seen as a riation on graduated payment plans, hich allow lower loan repayments during e early years of a farmer's career.[1]

ouisiana: The mechanism of the Louisiana amily Farm Loan Program (*Louisiana evised Statutes*) is similar to that of the innesota program. The 1980 Louisiana pro- am includes 90 percent guarantees on ommercial and seller-sponsored loans and adjustment of one-half of the interest ayment. No tax incentive provisions are cluded. The guarantee is not backed by a uarantee fund. When defaults occur, the amily Farm Council, which controls the ogram, must request funds from the legis- ture to pay the lender. The State Marketing ommission has successfully operated a ogram for agriculture-related businesses ith a similar guarantee arrangement for ore than 40 years. The first applications for uarantees were accepted in the spring of 982.[2]

exas: Another variation on the Minnesota oan guarantee and payment adjustment rogram was enacted in Texas in 1979 Texas, *Vernon's Annotated Revised Civil atutes of the State of Texas*). The program ncludes 90 percent guarantees and a 4 per- ent interest payment adjustment. The pro- ram was to have been funded by selling x-exempt revenue bonds, but Internal Rev- nue Service regulations prevented doing o.[3] Because of the lack of funding, the pro- ram has been suspended until September 983.

orth Dakota: North Dakota has a many- aceted group of programs for beginning armers: the 1978 joint FmHA and Bank of orth Dakota lending agreement to provide 00 percent financing; a 1979 tax incentive rogram to encourage landlords to sell or ease their land to beginning farmers (*North akota Century Code*, 57–38–67 to 7–38–70); a Minnesota-style guarantee program for seller-sponsored loans passed in 1981 (*North Dakota Century Code*, 54–17–29 to 54–17–31); and the 1981 North Dakota Agricultural Development Act (*North Dakota Century Code*, 4–36–01 to 4–36–27), which empowers the Industrial Commission to use tax-exempt bonds for farm credit. The 100 percent financing program is made possible by the unique institution of the Bank of North Dakota, which is the only state-owned bank in the United States. In many ways the joint FmHA and Bank of North Dakota program is more like the joint FmHA and Federal Land Bank loan program than like the loan programs in other states. Between July 1, 1978, and September 14, 1982, the program was involved in 395 loans with a total value of $25,999,275.

Tax incentives play a major role in the North Dakota program. A landowner who enters into a lease of three years or more on 20 acres or more of farmland with a qualified beginning farmer can exempt from state income taxes all of the rental income up to $25,000. A landowner who sells 20 acres or more to a beginning farmer can exempt from state income taxes for the year of the sale all the taxable capital gain. A landowner who enters into a contract for deed on 80 acres or more with a qualified beginning farmer can exempt all the interest income from state income taxes if the contract has a term of more than 15 years and the interest rate is not more than the IRS minimum. In 1980, 456 taxpayers claimed deductions of $2,656,331 under these provisions.

Iowa: The original Iowa Family Farm Development Act of 1980 (*Code of Iowa*, Chapter 175) created the Iowa Family Farm Development Authority (IFFDA) to issue public offerings of tax-exempt bonds and use the proceeds to finance real estate and non-real estate purchases by beginning farmers. The lack of an FmHA guarantee and IRS regulations on the grouping of tax-exempt bond issues prevented the implementation of the original program. A 1981 amendment to the Act, however, empowered the IFFDA to issue

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More details on the eligibility standards of the programs are available in Lowenberg-DeBoer and Boehlje.

As of June 1983 the Louisiana program is dormant. No guarantees have been made. Problems with the program included lack of funding for the payment adjustment.

[3] For a more detailed description of the problems Texas and other states have had with IRS bond regulations, see Lowenberg-DeBoer and Boehlje, pp. 10–11, 14.

bonds for individual beginning farmers. A separate tax-exempt bond is issued for each loan and placed privately with the local lender who makes and services the loan. Private placement of the bonds reduces or eliminates printing, marketing, and legal expenses. In 1982, 197 loans with a total value of $12.6 million were made under the program.

Georgia: In 1980 the Georgia legislature amended the Georgia Residential Finance Authority Act to empower the authority to issue tax-exempt bonds for farm financing (*Code of Georgia*, Chapter 99). The program was never implemented because of problems with obtaining FmHA guarantees. The legislation authorizes loans for real estate, equipment, and farm improvements.

Indiana: Legislation creating the Indiana Agricultural Development Authority was passed in 1981 (*Indiana Statutes*). Lending under the program is to be for both real estate and non-real estate purchases and will operate through local lenders. Implementation of the program has been delayed by the lack of FmHA guarantees and IRS regulations on tax exempt bond issues.

Evaluation of State Programs

A major question in the analysis of programs for beginning farmers is which approach is most cost-effective.[4] Ideally, the cost-effectiveness would be measured by empirical data on state expenditures and program success. Unfortunately, such data are not available; the programs are very young and their success is difficult to measure. Even if data were available it might be difficult to compare cost-effectiveness between states because of their vastly different production techniques, products, and environments. But budgets using the provisions of existing programs can help focus the analysis. If budgeted costs under identical conditions vary widely, the question is narrowed to one of comparative effectiveness. For example, it may not be possible to compare the effectiveness of policies for beginning farmers directly, but if it is known that one approach is 10 times more expensive than another, it may be possible to assess whether the more expensive approach is 10 times more effective.

All of the existing state programs for beginning farmers deal with the problem of resource control. The policy options for state legislatures that wish to reduce problems faced by beginning farmers in real estate control are (1) direct loans for real estate purchase with loan funds raised through tax-exempt revenue bonds; (2) guarantees on real estate loans from private sources; (3) tax incentives to encourage landowners to sell their land to young farmers; (4) tax breaks for landowners who lease their land to beginning farmers; (5) state purchase and lease of farmland to beginning farmers; and (6) subsidizing the savings of beginning farmers through matching grants. Options 1 through 4 are now being used by several states. Options 4 and 5 are in use in foreign programs for beginning farmers that are designed to deal with entry problems similar to those encountered in the United States. A provincial program that purchases farmland and leases it to beginning farmers has operated for the past decade in Saskatchewan (*Statutes of Saskatchewan*, Chap. 60, 1972). A program that offers matching grants on savings to be used in the purchase of farm real estate operates in New Zealand (*Statutes of New Zealand*, No. 45, 1974). Options for helping entrants meet their needs for non-real estate capital are similar to the direct loan, guarantee, and savings subsidy programs for real estate. Programs involving leasing of non-real estate resources are not readily available because of the undeveloped state of equipment, livestock, and facility leasing in agriculture and will not be considered in this discussion.

Real Estate Control

The approaches for helping beginning farmers control real estate differ substantially in their cost. Table 1 gives estimates of the cost to the public sector per dollar of real estate capital provided to a beginning farmer. The estimates were developed for conditions in Iowa in 1981, using an average real estate capital investment of $520,598 (USDA, *Eco-*

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[4] Other questions which analysis of these programs should answer are whether the state governments are the right authority for handling beginning farmers' problems, and whether the implementation of the existing beginning farmer programs fits the goal of reducing barriers to entry. These questions are dealt with by Lowenberg-DeBoer and Boehlje.

ble 1. Real Estate Control Program Costs per Dollar Invested[a] per Farmer under Iowa Conditions in 1981

	Direct Loan	Guarantee and Payment Adjustment	Farmland Leases and Purchase	Savings Subsidy	Tax Incentive for Sale	Tax Incentive for Lease
te sh costs year:			(in nominal dollars)			
1	0	0.1337	0.1345	0.0500	0.0126	0.0035
2	0	0.0330	0.0795	0	0.0124	0.0035
3	0	0.0323	0.0795	0	0.0123	0.0035
4	0	0.0315	0.0795	0	0.0121	0
5[b]	0	0.0306	0.0795	0	0.0119	0
deral cost year:						
1	0.0460	0	0.0505	0	0	0
2	0.0451	0	0.0505	0	0	0
3	0.0441	0	0.0505	0	0	0
4	0.0431	0	0.0505	0	0	0
5[b]	0.0419	0	0.0505	0	0	0
esent lue all vernment ost[c]	0.3248	0.1227	0.5537	0.0500	0.0982	0.0089

he cost per dollar of capital that the beginning farmer is to control, assuming that administrative cost is linear.

he costs of the direct loan, guarantee, and tax incentive programs continue to the twentieth year.

resent value of the cost to both state and federal governments per dollar invested for the life of the program.

omic Indicators of the Farm Sector,* p. 154). his investment represents about 268 acres t the 1981 average price of $1,941 per acre USDA, *Farm Real Estate Market Developnents,* p. 14). The cost estimates do not preume, however, that a beginning farmer nust start with an average size farm. Except or a small administrative charge in some rograms, the cost of the programs is a contant function of the capital requirement. lence multiplying the cost per dollar of apital by the beginning capital amount llows estimates to be made for cases in vhich farmers start on smaller than average arms, or in which program participants proide part of their beginning capital. Econonies of size in the financial markets are not onsidered in these estimates. Actual costs nay differ because of loan size, volume, nd other factors. All cost estimates assume hat, if a subsidy to sellers is involved, revenue bond buyers and landowners are in ipper income brackets; hence the uppernost marginal tax bracket is used, 50 perent for federal taxes and 13 percent for state taxes. None of the cost estimates nclude losses resulting from default. All of the estimates assume an operating program; original development costs are not considered.[5]

The direct loan program costs assume a 20-year 100 percent loan with a program participation fee paid by the farmer to cover administrative costs. Funds for the program are raised by the public or private sale of bonds. For simplicity it is assumed that the interest rate at which farm payments are amortized is the same as that paid on the bonds, as would be the case with private sale of bonds. The interest rate used is 9.19 percent, the rate on Aa municipal bonds in January 1981 (Moody's Investor Services, p. a10). This rate is also used for the calculations of present value. It is assumed that the bonds are paid off as the loan is repaid. The cost of the program to the federal government is the tax revenue lost. Iowa tax rules do not offer an exemption for revenue bond interest, so no tax revenue is lost by the state.

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[5] More details on how the estimates were derived are available in Lowenberg-DeBoer and Boehlje (1983).

This analysis of the cost of a direct loan program uses the tax expenditure approach. That is, tax exemptions are considered public expenditures just as are grants and subsidies (Surrey, p. 6–7, 35–40). If the public budget is seen as a process that must eventually balance, tax exemptions must be offset by higher taxes elsewhere or unmet needs in other programs. In modern economies the balancing may occur through inflation-induced tax bracket creep or cuts in effective program budgets instead of direct tax increases or program cuts, but the effect of tax exemptions is felt nonetheless. The tax expenditure approach is also used in the analysis of the tax incentive for sale and lease of farm real estate programs. Based on the tax expenditure approach to determining costs, the direct loan program would result in a present value of total cost of 32.48 cents per dollar invested. This cost is borne totally by all U.S. taxpayers through reduced tax revenues.

The guarantee and payment adjustment program estimate is based on a program such as Minnesota's. It is assumed that one dollar in the guarantee fund can be used to guarantee $10 in loans. An administrative cost of $352 per participant is based on the cost of the Minnesota program (Minnesota Department of Agriculture). The tax exemption for interest is not included in this estimate because tax exemption is considered as a separate approach. The payment adjustment is 4 percent. The payment adjustment period is assumed to be 10 years with repayment in the eleventh year. The guarantee fund is assumed to revert back to the state in the twentieth year. Calculations use a 20-year, 100 percent loan amortized at the Federal Land Bank interest rate for the first quarter of 1981—10.6 percent (Melichar and Balides, p. 32). It is assumed that the guarantee fund is a "safe" investment at 7 percent interest. In reality the guarantee fund might be invested in other municipal bonds, so that the interest rate on the fund could match the interest rate used for analysis of present values. But it seems likely that there is some opportunity cost in maintaining the fund, so a 7 percent return is used. Cost to the state in the first year of the program would include creation of the guarantee fund, administrative cost, and the payment adjustment. It is assumed that the guarantee fund is created at the beginning of the first year and that other payments are made at the end of the year. In the twentieth year, the guarantee fund is returned to the state. The present value of total cost over the years is 12.27 cents per dollar invested. The cost of this program is borne completely by taxpayers in the state. The guarantee program without the payment adjustment would have a present value of cost of 2.58 cents per dollar. The present value of the cost of a payment adjustment program without a guarantee is estimated at 10.30 cents per dollar.

The estimates for the land purchase and lease option were developed using the provisions of the Saskatchewan Land Bank program. The calculations assume that the funds for the land purchase are raised by public sale of bonds as provided under the Land Bank Act. Under U.S. conditions these bonds would be tax-exempt. It is assumed that the purchase and lease authority would be similar to the Iowa Housing Authority and would have its bond issues rated Aa. On the basis of Carr and Smith's argument that land bank programs inevitably pay more than market price for land, 10 percent was added to the real estate price. The lease rate was set at $101.80, the 1981 market rate for average Iowa farmland (USDA, *Farm Real Estate Market Developments*, p. 19). Other costs are a management fee of 7 percent of the gross rent ("An Inside Look at Farm-Management Fees," p. 21), a first-year charge of 5 percent of the purchase price to cover the cost of the bond sales and land acquisition. a maintenance and insurance cost of 2 percent of the purchase price, and a payment in lieu of taxes of $10 per acre.

The cost estimate assumes that the tenant opts to purchase the land in the sixth year, which is the earliest opportunity. The bonds are retired when the land is sold. The estimate in table 1 assumes that the land is sold to the tenant at the price for which the agency purchased it. Under these assumptions, the present value of total costs is 55.37 cents per dollar invested. If the land were sold at market value and real estate had appreciated 5 percent per year, the present value of the cost would be 37.57 cents per dollar. The costs of owning and leasing the land could easily be higher than those estimated in table 1 if land values were declining, the lease were set at a use value lower than market rate, or capital improvements were required. The state would probably be under more pressure than the ordiary landowner to make some capital nprovements, such as building soil conser-ation structures. Adoption of the European ractice of allowing the agency to preempt ales between nonrelatives might lower the nd cost for the purchase and lease pro-ram, but this is an unlikely development in e United States.

he cost estimate of the savings subsidy rogram is 5 cents per dollar invested. This stimate is based on the provisions of the lew Zealand Farm Ownership Savings Act *Statutes of New Zealand,* 1974, No. 45), hich offers capital grants to young farm uyers who have fulfilled the conditions of pecial farm purchase savings accounts. he amount of the grant is a percentage of e savings amount; the percentage rises ach year to a maximum of 50 percent at the enth year (Hill, p. 43). The estimate ssumes that the young farmer saves for ten ears before he begins farming and is able finance his purchase with 15 percent quity.

an entrant in 1981 wished to acquire the verage Iowa farm real estate holding $520,598) using a savings subsidy program, e would have to save $52,060. With a 7 per-ent rate of return, the entrant would have to ave $3,768 annually for ten years. If riskier nvestments were approved for the farm wnership accounts, a smaller annual sav-ngs would be required. At 12 percent inter-st, $2,967 savings per year is required.

he cost estimate for tax incentives to ncourage the sale of farmland to young armers is based on the provisions of the North Dakota legislation. The base estimate ssumes that all capital gains are tax-xempt; however, North Dakota rules limit apital gain exemption to the year of sale. The cost calculation assumes a 100 percent oan amortized over 20 years at 9 percent nterest, the IRS minimum interest rate for sales over $500,000. The calculation ssumes that the landlord's basis is $272, he 1964 Census of Agriculture average value of Iowa land. Under these assumptions, the present value of costs would be 9.82 cents per dollar invested.

If the exemption applied only to interest income, as is the case under the Minnesota legislation, the present value of costs would be 8.25 cents per dollar. If higher interest rates were allowed, the state tax loss would be greater because more interest income would be earned. If the 10.6 percent FLB interest rate for the first quarter of 1981 were used, the present value of costs would be 11.44 cents per dollar. Use of a down payment would lower the tax revenue lost by reducing interest income. No administrative cost is calculated because the program could operate through existing state revenue services with a minimum of added staff.

The cost of the tax incentive plan to lease land to beginning farmers is also based on North Dakota provisions. The lease is assumed to be for the minimum period of three years. The lease rate is the 1981 market average for Iowa, $101.80 (USDA, Farm Real Estate Market Developments, p. 19). The costs of landownership are assumed to be maintenance and insurance at 2 percent of the market value and property taxes of $10 per acre. The cost of the program is estimated at 0.89 cents per dollar invested.

Comparison of Costs: When the costs of the various programs are compared, the enthusiasm of state legislatures for farm lending programs funded by revenue bonds becomes clear. These are very low-cost programs for the state. A farmland lease and purchase program that operated as outlined would be costly for both the state and the federal government. Guarantee programs have a medium cost, but the cost may rise rapidly if a substantial number of defaults occur. Without payment adjustments, guarantee programs are relatively low-cost. If resource control is a goal without reference to landownership, the tax incentive plan for leasing is the least costly. The savings subsidy plan is the lowest-cost program to encourage real estate ownership.

It is clear that all the programs considered involve a substantial subsidy for the beginning farmer. A program that reaches enough entrants to make a significant impact on barriers to entry would require a major public expenditure. Assume, for example, that young farmers in Iowa in 1981 needed help in gaining control of about $310,000 in real estate capital. That amount of capital represents about 160 acres at the average value of $1,941 per acre. This is fewer acres than the average farm in Iowa, which could mean that the young farmer is starting with a smaller than average farm or that he or she is providing some of his or her own capital. Under this assumption, the present value of the public cost per entrant would be direct loans, $100,700; guarantee with payment adjustment, $38,000; farmland lease and purchase, $171,600; savings subsidy, $15,500; tax exemption for interest and capital gain income from sales to beginning farmers, $30,400; tax exemption for interest income alone, $25,600; and tax incentive for leasing, $2,800. For a high-cost lease and purchase program to assist 500 entrants, the present value of all public costs would be more than $85 million if land were resold at cost. The cash cost to the state in the first year of such a lease and purchase program with 500 participants would be about $20.8 million. In contrast, a program providing tax incentives for leasing to help 500 farmers would cost the public sector about $1.4 million in present value terms with a first year cash outlay of $542,500.

Effectiveness: The estimated costs are not exactly comparable because the effectiveness of the programs is likely to vary. Programs for beginning farmers should be evaluated on criteria in addition to cost, but unfortunately data are scarce and the effectiveness of such programs is hard to measure. This study uses program costs to focus analysis on programs that are most likely to be feasible. The lease and purchase of farmland would offer the state more control than other options and hence more potential for affecting barriers to entry, but this control comes with a high price. The other programs depend heavily on decisions by prospective farmers and landowners; for example, the savings program may be the lowest-cost ownership program, but its effectiveness depends on the planning and self-discipline of prospective farmers.

In particular, the effectiveness of credit programs to aid entry has been questioned. Research on the role of alternative financing plans in the entry process is not conclusive. Hanson and Thompson found that flexible repayment of principal and longer loan terms could significantly improve the debt-carrying capacity of new farm businesses. Kaiser found that the availability of plans for deferred principal payments or increasing payments had little effect on the optimal strategy of entering farmers. Lowenberg-DeBoer found that under the most liberal conventional terms available from commercial lenders the purchase of farmland by beginning farmers has been difficult throughout the century, but there is little evidence that it was more difficult during 1978–80 than it was earlier. Under the terms of 100 percent FmHA loans, he found that debt service was often even more precarious than with conventional terms because cash flows were not large enough to cover increased interest payments, even at subsidized interest rates. On the other hand, with the terms of the Minnesota Farm Security program, the debt service position is improved by the interest subsidy and the use of conventional down payment requirements.

Although the role and effectiveness of alternative credit plans to purchase a farm are unclear, evidence points toward problems arising from rental of farms as an entry strategy. Tenancy is the traditional entry path into agriculture for the low-equity beginning farmer, but census data indicate a decline in rental of whole farm units. Some studies indicate a trend away from rental agreements with low operator equity, such as crop and livestock share rental, toward cash rental, which requires more capital and risk taking on the part of the operator (Baron, p. 28; Harsbargen, Thomas, and Rolfes, p. 5). Furthermore, established farmers with expansion plans are in a strong position in the rental market, just as they are in the purchase market. In this light, the tax incentive for leasing may be seen as a step toward neutralizing some of the advantage of an established farmer. In a crop-share-lease agreement the landlord who rents to an inexperienced farmer assumes a greater risk of crop yield variability than if he rented to an established operator. Weeds and pests may not be properly controlled; the beginning farmer may have inadequate equipment for timely field operations. Even with cash rental a landowner may still fear the development of weed problems. The reduced tax burden on rental income may offset this risk, but whether or not the tax incentive is large enough to be effective depends on the risk adversity of the landowner and his estimate of the risk involved.

on-real Estate Capital

he analysis of costs for alternative pro-ams to help beginning farmers obtain non-al estate capital follows a pattern similar that of the real estate control programs able 2). The estimates were developed for wa conditions in 1981 including average apital investment in livestock, motor vehi-les, and equipment worth $93,236 (U.S. epartment of Agriculture, *Economic Indica-rs of the Farm Sector,* p. 154). Like the real state capital program estimates, the costs f non-real estate programs are a constant nction of the capital requirement, except r a small administrative charge in some rograms. Hence the estimates may be used nder varying capital requirements.

he direct loan costs are calculated assum-g a program in which administrative costs re covered by a participation fee paid by armers, the repayment period is seven ears, and the interest rate on the loan is .19 percent, the same as the interest rate n the bonds, as would be the case with pri-ate sale of bonds. Calculations assume that e bonds are redeemed as loan payments re made, so the bond principal outstanding reduced by loan principal payments. Jnder these assumptions the present value f public costs for a non-real estate direct oan program would be 15.36 cents per lollar invested.

he guarantee program estimates were generated by adapting Minnesota Farm Security rogram provisions to non-real estate. No nterest payment adjustment is used in the ase estimate. The calculations use a 7-year oan term, 100 percent loan, 12.9 percent nterest rate, and 7 percent return on the uarantee fund. The loan interest rate is the CA rate for the first quarter of 1981 (Melichar and Balides, p. 32). Under these ssumptions the present value of public osts for a guarantee program would be 2.96 ents per dollar invested.

f an interest payment adjustment of 4 percent is used, the present value of all costs is 7.84 cents per dollar invested. In all guarantee fund estimates it is assumed that the fund reverts to the state in the last year of the guarantee. If the cost of defaults were figured into the guarantee program estimates, the costs could be expected to rise by a greater percentage in the non-real estate program than in the real estate program. Real estate has generally appreciated in value, but non-real estate could be expected to depreciate, so greater losses could be expected from defaults.

Table 2. Non-Real Estate Capital Cost per Dollar Invested[a] per Farmer under Iowa Conditions for Three Programs in 1981

	Direct Loans	Guarantees	Savings Subsidy
	(in nominal dollars)		
State cash cost first year:	0	0.0968	0.1333
Federal cost in year:			
1	0.0459	0	0
2	0.0410	0	0
3	0.0356	0	0
4	0.0296	0	0
5	0.0232	0	0
6	0.0161	0	0
7	0.0084	0	0
Present value of all government costs: [b]	0.1536	0.0296	0.1333

[a] The cost per dollar of capital that the beginning farmer is to control, assuming that the administrative charge is linear.

[b] Present value of costs of both federal and state governments per dollar invested for the life of the program.

The savings program estimates were generated by adapting the New Zealand Farm Ownership Savings Program provisions to non-real estate. The calculations are based on $93,239 of non-real estate property to be acquired with 40 percent owner equity. The full 50 percent grant after a 10-year savings period is assumed. The present value of public costs under such a savings program would be 13.33 cents per dollar invested.

An entrant who wished to acquire the average 1981 Iowa non-real estate capital worth $93,236 with a requirement of 40 percent equity would have to save $24,863 before starting farming. At a 7 percent interest rate this would require saving $1,799 annually for ten years. At 12 percent interest the annual savings would need to be $1,417. If a savings subsidy plan were instituted for both real estate and non-real estate capital, an annual savings rate of $5,566 at 7 percent interest over 10 years would be required to save sufficient equity to purchase the average Iowa farm. At 12 percent interest the annual savings would need to be $4,382. Raising the government matching grant percentage would lower the savings required.

Effectiveness: The effectiveness of programs to help young farmers acquire non-real estate capital is closely tied to those farmers' control of real estate. Except for a few farmers who start with intensive livestock production on a small land base, a non-real estate capital program would be of little benefit unless land was available. But a non-real estate capital program may reduce the problem of undercapitalization; a young farmer with adequate equipment and livestock stands a better chance of renting land or borrowing money for real estate purchase.

Non-real estate capital programs have the advantage of offering aid to the most vulnerable group of beginning farmers: entrants with low equity who start as tenants. Trends toward increased use of equipment, specialized livestock facilities, and more nonfarm inputs have increased the capital requirements for tenants dramatically. Credit terms for non-real estate purchases have also been liberalized, but compared to the terms used for real estate purchases, the equity requirements are high and repayment periods are short. In addition, the public cost of non-real estate programs tends to be relatively modest. Under the assumptions of this study and assuming that each beginning farmer required help in gaining control of $50,000 in non-real estate capital, the present value of the public cost of helping 500 entrants would be $3.8 million for a direct loan program, $740,000 for a guarantee program without a payment adjustment, and $3.3 million for a savings subsidy plan.

Summary

Although the lack of empirical research prevents definite conclusions, this analysis suggests two major problems with the approaches chosen by state legislatures for assisting beginning farmers. The states have tended to choose relatively expensive programs, even though there is little evidence that they are more effective in aiding entry than lower-cost methods. States have also concentrated on the need for credit to the neglect of other entry problems.

Except for a direct loan provision for non-real estate credit in the Iowa program, all state entry programs in operation during the 1982 crop season addressed the problem of control of the real estate resource. The methods used were direct loans funded by revenue bonds for real estate purchase, loan guarantees to buy land with payment adjustments, tax incentives to encourage the sale of farm real estate to young farmers, and tax incentives for leasing land to young farmers. Under the assumptions of this study the direct loan, loan guarantee, and tax incentive for sale programs all had present values of public cost of over 8 cents per dollar invested. In itself, a loan guarantee program is not expensive, but the addition of payment adjustments raises costs dramatically; for example, under the assumptions of this study, the present value of public cost for a real estate loan guarantee program with a 4 percent payment adjustment is 12.27 cents per dollar invested while a simple guarantee program would have a present value of cost of 2.58 cents per dollar invested. Only North Dakota used the low-cost tax incentive for leasing approach, which has a present value of public cost under 1 cent per dollar of capital controlled. Nowhere in the United States has the high-cost land bank program been used.

The cost estimates show the direct loan programs based on revenue bonds to be the highest-cost entry programs now in use in the United States. The direct loan programs are attractive to state legislators because costs to the state are low, but the overall public cost is high. Under the assumptions of this study, such a loan program for real estate control is about three times more expensive than a guarantee program with a payment adjustment or a tax incentive program for real estate sale; about six times more expensive than a savings subsidy approach; and about thirty-six times more expensive than a program that offers tax incentives for leasing.

In addition, the fact that the majority of the cost of revenue bonds is borne at the federa level contradicts one of the arguments in vor of state-level programs. State programs iould allow voters a greater choice of pro- ams and level of funding, but if they are ised on tax-exempt revenue bonds, citi- ens nationwide are forced to finance a pro- am that they have not chosen to support. ate programs for beginning farmers do cre- e some externalities, but that does not jus- y transferring the bulk of the cost to the deral government. From this standpoint, ograms with tax incentives for sale or ase are easier to justify because the tax ost affects only the state in which the pro- am is used.

he second major problem is that the states ave focused on credit, and especially real state credit, while neglecting other promis- ig and less costly methods to assist begin- ing farmers. Although not all the programs e operational, all seven states with legisla- on to assist beginning farmers have cre- ed credit programs. Extension of credit as a long and successful history as a tool r helping improve farm income and living andards. But it is not clear that the prob- ems of today's beginning farmers can be olved with more credit or more liberal redit terms.

is often argued that the state credit pro- rams supplement inadequate FmHA funds. he long waiting lists for FmHA loans are ited as evidence of such inadequacy. In the ast, however, limited funds have been a roblem primarily with FmHA farm owner- hip loans (LaDue (b), p. 11), and research as raised the question whether the owner- hip of farm real estate is critical in the entry rocess. The marginal entrant, on whose ntry limited public funds could have the reatest impact, should probably start farm- ng as a tenant. This entrant's problems vould center on finding rental land and on-real estate capital. The only credit pro- ram likely to help such a beginning farmer vould be one that assisted in acquisition of quipment and livestock; yet during the 982 crop season only one state program rovided funds for such purposes. Alterna- ives to credit programs might be state rants to match all or part of savings to help nore entrants qualify for commercial credit, ax incentives for leasing land to beginning armers, programs to help young farmers eal with risk, and farm management and n-the-farm training programs (Boehlje and Thomas pp. 24–25).

In general, our analysis suggests that the choice of programs raises questions of cost-effectiveness. Credit programs tend to be expensive and may not provide effective assistance. Federal credit programs clearly have faults, but duplicating those services at the state level may not be the most economical way to correct the faults. Real estate ownership programs, whether they operate through credit or tax incentives, are also costly and may ignore the needs of the entrant whose net worth is low. In light of this analysis, state legislators contemplating new entry programs or reexamining existing programs would do well to consider low-cost alternatives such as matching grants for savings and tax incentives for leasing. If a credit approach is adopted, provisions for non-real estate financing may increase the effectiveness of the program.

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Loan Pricing and Profitability Analysis by Agricultural Banks

Peter J. Barry and Jeffrey D. Calvert

Abstract

The unique characteristics of agricultural banks combined with a changing financial environment have made loan pricing and profitability analysis important banking ssues in the 1980s. This article presents results from a nationwide survey of agricultural banks about their pricing and profitabilty analysis of farm loans. Results indicate widespread use of various pricing methods, although base rate policies, floating rates, marginal cost pricing, balances, differential pricing, and customer profitability analysis are used more formally by large banks with more complex legal structures. Structural changes in banking suggest greater use of these methods in the future.

Key words: agricultural banking, loan pricing, farm lending.

The unique characteristics of agricultural banks combined with a changing financial environment have made loan pricing and profitability analysis important banking issues in the 1980s. Agricultural banks are generally smaller than their urban counterparts, and their activities are concentrated in more localized markets. The rural location makes these banks especially vulnerable to changes in farm income, which affect their customers' loan demands, repayment prospects, and deposit activities. Such local conditions along with the more unstable, rate-sensitive, and financially competitive environment of the 1980s, attributed in part to financial deregulation, are bringing new challenges to the balance sheet managers of agricultural banks. More market-oriented pricing and performance analyses are anticipated at the bank, department, and customer levels.

Only limited information is available about loan pricing and profitability analysis by agricultural banks. Aggregate data on terms of bank lending to farmers are published quarterly by the Board of Governors of the Federal Reserve System. Some Federal Reserve banks and the American Bankers Association also conduct periodic surveys about farm credit conditions. Studies by LaDue et al., Hardy and Moore, Schramm and Barry, and Pennsylvania State University have focused on costs of farm lending and other banking characteristics for relatively few banks in selected geographic areas. Still other studies (e.g., Knight; Reich and Neff; Simonson and Pace; Jepson and Parkinson; Flynn) have considered pricing and profitability analysis for corporate lending by larger banks.

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This paper presents results from a nationwide survey of agricultural banks about their pricing and profitability analysis of farm loans. These results provide a comprehensive information base and show how these practices differ by bank size, legal structure, and involvement in farm lending. The following sections describe the study's conceptual base and survey procedures, present some of the results, and consider the implications for banks and farm borrowers.

Pricing and Profitability Concepts

Loan pricing and profitability analysis are important functions in a bank's total balance sheet (or asset-liability) management. Balance sheet management involves simultaneous consideration of assets and liabilities in structuring a portfolio to achieve desired levels of expected performance (Baker; Miller; Binder). The approach jointly considers the bank's loans, investments, reserves, deposits, borrowings, and equity capital. The volume, mix, maturity, yield, cost, risk, and liquidity of the resulting portfolio are then judged optimal.

Much of the recent emphasis in asset-liability management is attributed to greater cost-of-funds risk. Banks have responded to this risk by seeking a higher correlation between their costs of funds and the returns on loans, investments, and other assets. Such strategies as floating rates, matching maturities on assets and liabilities, fixed rate premiums, pooling funds, holding greater reserves, and financial futures have been considered and implemented in varying degrees. Effective use of these practices generally involves greater precision in a bank's accounting, pricing, and financial analysis than has previously occurred.

Within balance sheet management, the basic principles of loan pricing and profitability analysis are (a) to price loans so that their contribution to bank profits is commensurate with desired profit targets, and (b) to evaluate loans ex post to determine if profit targets were achieved (Mason, chapters 9, 10). The scope of analysis may include lending activities at the bank, department, and customer levels. In the past, loan pricing by banks was highly aggregated because of their insulated market positions, inadequate cost accounting, high costs of information about customers' credit-worthiness, and the strong role of the customer loan-deposit relationships (Baltensperger; Hodgman; Mason). At present, however, the effects of greater competition from bank and nonbank institutions, higher banking risks, computer-assisted cost accounting, and improved financial information from borrowers are all encouraging disaggregation of pricing and profitability analysis to enhance bank performance.

At the customer level, for example, loan pricing should assure that loans of individual borrowers are priced to contribute to bank profits at levels.that cover the costs of administering and funding the loan, as well as compensating for lending and liquidity risks. Pricing may also reflect different degrees of competition for the customer's loan business. Pricing occurs through the explicit use of interest rates, fees, and service charges, as well as through nonprice responses such as differences among borrowers' balance requirements, loan limits, security requirements, loan supervision and documentation, and other means of credit administration.

In this study we sought to identify agricultural banks' major practices in pricing loans and evaluating loan profitability at the customer level and for their total farm lending activity. The banks responded to questions about (a) different methods of measuring costs of funds and relating them to loan rates; (b) use of floating rates; (c) varying loan maturities; (d) offering credit commitments or lines of credit; (e) requiring or recommending compensating balances; (f) levying fees or service charges; (g) charging different interest rates among customers; (h) use of customer profitability analysis (CPA); and (i) use of accounting centers for farm lending. We also considered interest rate comparisons among different bank loans and the bankers' perceptions of competition from other farm lenders. Many of these responses were analyzed according to bank size, legal structure, and involvement in farm lending. We believed that the pricing practices are influenced by these banking characteristics and anticipated that larger, less specialized banks with more complex legal structures could more readily use the more refined practices in loan pricing and profitability analysis.

Survey Methods

The data for this study were provided by a mail survey of a stratified random sample of banks in the United States that are substantially involved in farm lending. Banks with $2.5 million or more of farm loans or with a ratio of farm loans to total loans above .50 were included. On January 1, 1981, a total of 4,900 banks met these conditions. Of these banks, 1,610 were randomly selected for the survey, using a stratified sampling approach in which five geographic regions and six categories of bank farm loan volume were sampled at rates based on strata size and past response rates (Calvert and Barry).[1]

The survey responses were summarized and analyzed statistically based on analysis of variance and correlation procedures. The responses were categorized by bank size, legal structure, and degree of involvement in farm lending to analyze the effects of these characteristics on the results. Bank size is based on the dollar value of a bank's total assets. Involvement in farm lending is measured by a bank's ratio of farm loans to total loans.[2] Legal structure of each bank may be (a) statewide branching; (b) limited branching; (c) unit banking; (d) unit banking and affiliation with a multibank holding company (MBHC); and (e) limited branching with MBHC affiliation.

Survey Results

The results presented here are organized as descriptive characteristics of agricultural banks, their practices in pricing farm loans and evaluating loan profitability, and pricing relationships among loan types and between banks and other farm lenders. Significant statistical relationships between pricing practices and bank characteristics are also indicated.

Descriptive Characteristics

The survey responses came from 451 banks in 37 states representing all regions of the country; the response rate was 28 percent. Respondents appeared to be highly representative of the population of agricultural banks, as defined above, although a precise evaluation was hampered because information about their structural and performance characteristics was limited. The typical respondent to the survey appeared slightly larger in total assets, had a larger loan volume, and was more likely to be a branch bank or affiliated with a multibank holding company than was the typical agricultural bank (Calvert and Barry).

The average respondent bank held $97 million of total assets. The size distribution was heavily concentrated among smaller banks, with 50.9 percent having total assets less than $25 million and 76.3 percent having total assets less than $50 million. The average bank had $6.6 million of total farm loans, a .44 ratio of farm loans to total loans, a .60 loan-to-deposit ratio, 222 farm borrowers, and a 1.44 percent return on assets for 1980. The banks' legal structure was categorized as follows: 78.1 percent independent unit banks, 12.7 percent unit banks affiliated with a MBHC, 3.4 percent statewide branching banks, 3.6 percent limited branching banks, and 2.2 percent limited branching with MBHC affiliation.

Most banks (93.2 percent) indicated a local market for farm lending. With few exceptions, the remaining banks operated in regional markets. Consistent with their small size, most banks account for farm lending as part of their commercial or total lending

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[1] The sample was drawn by the American Bankers Association based on geographic regions and response rates of past ABA surveys. The sample size was based on an anticipated response rate of 35 percent and a tolerable error of 5 percent. A total of 451 banks responded to the survey giving an actual response rate of 28 percent.

The use of stratified random sampling meant that responses from the sampled banks were weighted according to the strata size relative to the population size of agricultural banks in order to derive means and confidence limits for the population parameters and to statistically analyze relationships among the various observations on bank characteristics (Calvert and Barry; Snedecor and Cochrane).

[2] To aid in presenting the data, the variables for bank size and farm loan ratio were categorized as follows: asset size—$0 to $10 million, $10 to $25 million, $25 to $50 million, $50 million to $100 million, $100 million to $1 billion, and over $1 billion; farm loan ratio—0 to 10 percent, 10 to 25 percent, 25 to 50 percent, 50 to 60 percent, 60 to 75 percent, and over 75 percent. Despite these categories, the tests of significance for bank size and farm loan ratio were based on continuous measures for these variables. A statistically significant negative relationship occurred between bank size and the farm loan ratio. In addition, more densely structural banks tended to be significantly larger with lower farm loan ratios.

Table 1. Determinants of Base Farm Loan Rates and Cost of Funds, Classified by Bank Size, Structure, and Farm Loan Ratio

	Base Farm Loan Rate[a]				Cost of Funds Based on[b]		
	Spread Over Funds Cost	Percent Markup	Local Competition	National Rates	Marginal Funds	In-House Funds	Both
	Percent of Agricultural Banks						
All responses[c]	58.8	30.5	44.1	8.4	8.6	76.9	14.5
Bank Size							
$0–10 million	55.7	38.6	50.0	6.8	3.7	86.4	9.9
10–25 million	64.8	33.8	40.1	5.6	5.1	78.9	16.0
25–50 million	54.4	23.7	42.1	10.5	6.2	85.8	8.0
50–100 million	60.7	32.8	39.3	18.0	12.6	73.6	13.9
100–1,000 million	51.2	17.1	51.2	9.8	22.9	39.6	37.5
Over $1 billion	53.3	22.1	47.8	25.5	52.6	26.6	20.8
Structure							
State branch	29.9	10.9	85.0	2.7	27.6	60.6	11.8
Limited branch & MBHC	91.6	17.9	55.8	21.1	0.0	14.8	75.2
Unit & MBHC	49.1	47.3	41.8	18.2	9.2	66.2	24.6
Limited branch	42.9	22.4	46.2	7.1	1.7	84.7	13.6
Unit	62.3	30.0	41.8	8.6	7.6	81.2	11.2
Farm loan ratio							
0–10%	45.9	24.3	51.4	21.6	44.0	30.5	22.5
10–25%	39.5	22.2	45.7	18.5	8.5	75.1	16.4
25–40%	70.1	32.2	39.1	6.9	6.0	78.7	15.3
40–60%	61.9	36.3	39.8	7.1	6.0	78.5	15.3
60–75%	68.4	23.7	48.7	2.6	7.5	80.5	12.0
Over 75%	57.4	42.6	46.3	7.4	3.0	93.0	4.0

[a] Methods of determining base rate differ significantly at the 5 percent level by bank size, structure, and loan ratio.

[b] Cost of funds basis differs significantly at the 5 percent level by bank size, structure, and farm loan ratio.

[c] The sum of percentages may exceed 100 because banks may use more than one determinant.

activity. Only 4 percent of the banks (predominantly larger ones) had a separate profit center for farm lending.

Cost of Funds and Base Loan Rate

One section of the survey focused on the banks' determination of base interest rates on farm loans. Included was information about relationships between costs of funds and loan rates, pooling methods, and average versus marginal costs of banks, as well as competitive responses in local and national markets. As table 1 shows, nearly 60 percent of the banks determine their base (or prime) farm loan rates as a spread over the cost of funds. About 30.5 percent use a percentage markup over the cost of funds, local competition is an important determinant for 44 percent of the banks, and only 8 percent consider national rates in pricing farm loans. These percentages total more than 100 because many banks used more than one indicator in setting base rates.

The use of these rate determinants also differs significantly among banks of different size, legal structure, and farm loan ratio. National rates were more important for larger, less specialized banks that likely lend in national markets. Local competition is a significant factor in statewide branching systems, with national rates appearing more prominent in MBHC systems. The spread and markup methods appear stronger among smaller unit banks, although the mean values in table 1 suggest fairly uniform use of the spread method across most bank categories.

Table 1 also indicates how marginal and average costs of funds are accounted for in farm loan pricing. Here marginal refers to the cost of "marginal funds to be brought in to your bank" and average refers to the cost of "funds already in your bank." Accounting

Table 2. Farm Loan Pricing and Profitability Analysis of Agricultural Banks, Classified by Bank Size, Structure, and Farm Loan Ratio

	Use Floating Rates[a,b,c]	Require Recommend Balances[b,c]	Vary Loan Maturity	Offer Credit Commitments	Fees or Service Charges	Different Customer Rates[b,c]	Use CPA[a,b,c]
	Percent of Agricultural Banks						
All responses[c]	37.6	38.9	46.9	59.7	2.1	47.0	12.6
Bank size							
$0–10 million	12.8	35.8	48.0	29.3	0.0	37.9	3.2
10–25 million	24.7	29.4	56.6	54.7	0.4	31.2	9.4
25–50 million	38.4	30.3	33.3	61.0	0.0	51.0	8.4
50–100 million	66.4	51.5	41.7	87.4	7.0	61.5	14.9
100–1,000 million	81.5	66.5	55.2	93.7	6.2	82.0	46.2
Over $1 billion	95.6	63.5	51.7	100.0	30.2	86.8	60.5
Structure							
State branch	88.9	47.3	39.9	98.7	2.8	88.7	53.3
Limited branch & MBHC	97.4	65.2	79.3	100.0	10.4	100.0	10.4
Unit & MBHC	54.2	50.9	53.5	77.3	3.7	62.5	21.9
Limited branch	50.5	65.4	42.6	93.2	6.7	64.0	25.0
Unit	30.4	35.3	45.9	52.7	1.3	40.2	8.8
Farm loan ratio							
0–10%	80.4	74.1	48.0	98.0	6.4	80.6	46.0
10–25%	61.5	46.3	36.7	74.4	3.3	63.9	21.7
25–40%	37.5	42.4	40.3	72.5	1.6	50.3	5.8
40–60%	23.2	31.2	51.5	51.9	1.3	36.4	3.9
60–75%	22.8	29.9	50.6	38.5	1.2	32.9	12.3
Over 75%	21.6	24.9	56.3	36.9	0.0	34.6	5.9

[a] Differs significantly at the 5 percent level by bank size.

[b] Differs significantly at the 5 percent level by bank structure.

[c] Differs significantly at the 5 percent level by farm loan ratio.

for the marginal cost of funds is not widespread among agricultural banks; only 8.6 percent of the banks used this method alone. About 77 percent measured the costs of funds already in the bank, and 14.5 percent use both methods of cost accounting. These cost accounting methods differ significantly among the various bank categories, however, with marginal cost accounting more prominent in the size categories above $100 million.

Most agricultural banks (73.3 percent) determine their cost of funds as a weighted average of a pool of funds. About half include noninterest costs in the weighted average; the rest do not. The more common components of the funds pool were transactions accounts, savings accounts, and various certificates of deposit (CDs). Fewer banks included repurchase agreements, federal funds, borrowed funds, and equity capital in the pool. Others (34.2 percent) closely monitored the cost of a single source of funds either along with a funds pool or as the only measure of funding costs. When a single source was used, it was predominantly the six-month money market certificate. Costs of large CDs and federal funds received minor use.

The frequency of monitoring costs of funds also differed among banks. About half reviewed their costs of funds weekly for possible adjustments in base loan rates. Monthly reviews were conducted by 29 percent of the banks, and 8.5 percent indicated daily reviews.

Loan Pricing Methods

Another major section of the survey focused on the banks' major practices in pricing loans and evaluating loan profitability, both in total and at the customer level. The results are summarized in table 2. Floating interest rates on farm loans were used by 37.6 percent of the banks in mid-1981. The use of floating rates increased significantly as bank size increased and as farm loan ratios decreased; this practice was also more common in branching and MBHC systems. The survey also indicated that 40 percent of the banks reviewed floating rate loans monthly for possible rate adjustment, whereas 16.2 percent reviewed rates on a daily basis, 18.3 percent weekly, and 13.8 percent quarterly. Nearly 90 percent of the banks did not limit the size of rate adjustment.

Compensating balances on farm loans were required or recommended by 38.9 percent of the banks, although a significantly larger number of branch or MBHC banks, as well as banks with low farm loan ratios, formally rely on balances. Balance policies also appear stronger at large banks, based on the averages in table 2, although the relationship was not statistically significant.

About 47 percent of the banks indicated they may vary farm loan maturities in loan pricing. This practice appears fairly uniform among bank sizes and legal structures, but differs significantly when banks were classified by the farm loan ratio. A joint analysis of floating rates and varying maturities indicated that 16.5 percent of the banks used both methods, 31.9 percent used neither method, 30.5 percent used only varying maturities, and 21.1 percent used only floating rates. Correlation results indicate that these two pricing practices are used independently by the agricultural banks.

About 60 percent of the banks provide credit commitments to farm customers using a master note, line of credit, or other similar arrangement. Credit commitments appear to increase with bank size, although this relationship was not statistically significant. Their use is much greater, however, among banks with low farm loan ratios and branching or holding company characteristics. Fees or service charges on farm loans were used by only 2 percent of the banks, and there were no significant relationships between fees and bank size, legal structure, or farm loan ratio.

Differential pricing among customers occurred in 47 percent of the banks; this practice was used most by banks with lower farm loan ratios and nonunit structures. Size of bank made no significant difference although averages for the size classes in table 2 indicate that larger banks are more likely to use differential pricing. Use of differential pricing was attributed by 95.7 percent of the banks to differences in customers' credit risks. Other factors associated with differential pricing include differences in deposit balances, loan maturity, loan purpose, and, to a lesser degree, loan size and market competition.

The relatively widespread use of deposit balances (62 percent of the banks involved) as a criterion for differential pricing contrasts with the relatively low incidence of requiring or recommending compensating balances on farm loans. Moreover, 38.6 percent of the banks that use deposit balances as a criterion for differential pricing do not require or recommend balances. Thus, without having a definitive balance policy, many banks offer a lower interest rate to borrowers who have larger deposit balances.

Only 12.6 percent of the agricultural banks use customer profitability analysis (CPA) or other formal methods of evaluating loan costs and revenues. The use of CPA increases significantly, however, as bank size increases and farm loan ratios decrease and in banks organized in branching and/or holding company systems.

Relationships among Loans and Lenders

The survey also elicited the bankers' responses about interest rate comparisons for different types of bank loans and their perceptions of competition from other farm lenders. These results are summarized in tables 3 and 4.

Farm loan interest rates were stated to be the same as commercial loan rates at 75 percent of the banks and lower at about 21 percent of the banks. This result is consistent with most banks' practice of accounting for farm loans as part of their commercial or total lending activity. Differences that did occur in farm and commercial rates were primarily attributed to differences in the borrowers' credit risks and to market competition. In contrast, 40.8 percent of banks indicated that farm loan rates were higher than mortgage loan rates, primarily because of differences in credit risks and market competition. Thus farm lending appears more risky and less competitive than mortgage lending; differences in lending costs and loss rates were less important for these rate comparisons.

Table 3. Interest Rate Comparisons among Farm, Commercial, Mortgage, and Installment Loans

	Commercial Loans	Mortgage Loans	Installment Loans
	Percent of Agricultural Banks		
A. Interest rates on non-real estate farm loans are:			
Higher than	3.9	40.8	23.5
Same as	74.9	45.6	30.5
Lower than	21.2	13.6	46.0
B. Rate differences are due to differences in:			
Lending costs	27.9	29.7	51.3
Credit risks	69.2	49.7	55.0
Loss rates	36.5	30.8	42.8
Market competition	55.8	43.8	23.6
Other	4.8	11.4	17.3

Table 4. Competitive Relationships between Agricultural Banks and Other Lenders

Lenders	Are They Competitors?	Interest Rate Effects?
	Percent yes	
Other banks	94.3	66.1
Production Credit Associations	90.3	46.6
Federal Land Banks	46.2	13.4
Farmers Home Administration	46.4	12.3
Life Insurance Companies	13.4	3.2
Merchants and Dealers	30.0	12.1

Rate comparisons for farm and installment loans are more diverse. Farm loan rates were higher in 23.5 percent of the agricultural banks and lower in 46 percent. Although credit risks were important in these comparisons, differences in lending costs and loss rates were more important than in commercial and mortgage lending. Thus, on balance, farm loans appear less costly and less risky than installment lending. Other factors, indicated primarily as binding usury laws on installment lending, may further explain some of the rate differences. In general, these results appear consistent with those of other studies analyzing lending costs (LaDue, et al.; Hardy and Moore).

Table 4 indicates the agricultural bankers' perceptions of competitive relationships with other farm lenders. The bankers were asked whether they consider the other lenders in their market area to be competitors and whether their loan rates were affected by those of other banks. More than 94 percent of the banks regarded other banks as competitors. The responses about competition (not shown in the table) were nearly uniform across all categories of bank size, legal structure, and farm loan ratio. The price effect from other banks appeared to increase with increased bank sizes, smaller farm loan ratios, and more densely structured banks.

In total, 90.3 percent of the banks regarded Production Credit Associations (PCAs) as competitors, with no significant differences in responses occurring across bank size, farm loan ratio, and bank structure. About 47 percent of the banks indicated that PCA competition affects their farm loan rates. This price effect tends to increase for larger banks,.especially when total assets exceed $25 million, and for the statewide branching and unit-MBHC banks.

Federal Land Banks (FLBs) and the Farmers Home Administration (FmHA) were ranked next in lending competition, although considered less of a competitor than banks and PCAs. Only 12 to 13 percent of the agricultural banks indicated that FLBs and FmHA interest rates affected their farm loan rates. The low response for FLBs likely reflects their emphasis on farm real estate lending, which is comparatively minor for agricultural banks. Less competition from FmHA was anticipated because they are considered a lender of last resort for farmers who cannot obtain credit from commercial sources. But the level of FmHA competition indicated by banks was still fairly strong and consistent with the rapid growth in FmHA lending during 1978 to 1982. Finally, merchants, dealers, and life insurance companies were considered minor sources of loan competition.

Concluding Comments

These survey results indicate that agricultural banks make widespread use of various methods of pricing farm loans and evaluating the profitability of farm customers. Moreover, the disaggregation of many of these methods to account for differences in risk, balances, and lending costs among customers appears fairly strong, on the increase, and consistent with banks' anticipated responses to greater financial competition. These responses reflect the closer integration of farm credit conditions with national market conditions as financial deregulation continues.

Many of these pricing methods are used formally by large banks in which farm lending is a relatively minor activity and by banks with more complex legal structures. This appears especially true for base rate policies, separate accounting of farm lending, floating rates, marginal cost pricing, credit commitments, balance policies, differential pricing, use of CPA, and competitive price responses to other lenders. Among the structural categories, perhaps the most noticeable differences occur between unit banks with and without MBHC affiliation. Of the MBHC-affiliated unit banks, for example, 54.2 percent used floating rates, 62.5 percent used differential pricing, and 21.9 percent used CPA; among the independent unit banks, only 30.4 percent used floating rates, 40.2 percent used differential pricing, and 8.8 percent used CPA. No significant differences in asset size occurred between these two types of banks.

These results suggest that farm loan pricing may follow the trends in bank size, geographic scope, and legal structure that characterize increasing financial deregulation. Consolidation in the number, size, and control of rural banks may continue as competition in banking markets increases and as geographic restrictions are liberalized. Farm lending, in turn, may become more concentrated in banks with $50 million to $100 million in total assets, with larger farming operations seeking larger banks.

These banking directions also suggest that farmers and other rural borrowers should anticipate pricing policies that are more commonly used by larger banks in commercial lending. Greater tailoring of interest rates to the risk characteristics, lending costs, and loan competition for individual customers will reflect the greater precision in pricing of banks' products and services. These pricing effects may seem to increase financial risks for farmers because changes in interest rates are obvious and easily measured. But higher rate variability should be offset in part by reduced swings in fund availability, which many agricultural banks experienced in the past. Nonetheless, farmers must be better prepared in financial accounting, planning, analysis, and control and be aware of trends and forces in financial markets as they compete for credit services in the future.

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Financial Impact of Mandatory Equity Programs on Farmer Cooperatives

By Jeffrey S. Royer

Abstract

Farmer cooperatives have recently been placed under increased pressure to retire patron equities. The U.S. General Accounting Office has suggested the possibility of requiring cooperatives to pay interest or dividends on retained equities and/or retire retained equities within a certain time. Analysis of the impact of these programs and two alternative programs was conducted using a deterministic growth model. The primary disadvantage of mandatory equity programs is the loss of financial flexibility that cooperatives would incur. To avoid the threat of mandatory equity programs, cooperatives need to do a better job of retiring and servicing patrons' equity.

Key words: cooperative finance, equity retirement, mandatory equity programs, cash patronage refunds, growth.

Farmer cooperatives have recently been placed under increased pressure to adopt more effective programs for retiring patrons' equities. In some cases, former patrons and estates have voiced considerable frustration over their inability to force cooperatives to redeem their equities. As a result, mandatory programs for retiring and servicing patrons' equity have been discussed at both the state and federal levels.

The equity redemption issue follows an apparently poor record of performance by cooperatives. In their 1974 study (published in 1977), Brown and Volkin found that 29 percent of cooperatives surveyed did not have equity retirement programs. An additional 39 percent redeemed equity only in response to special circumstances. Of centralized cooperatives surveyed, 69 percent had allocated equity issued to patrons who were no longer active. In fact, 56 percent of the equity holders in centralized cooperatives were inactive, and they held 22 percent of total allocated equity (pp. 5, 22, and 23).

The absence of effective equity retirement programs has caused serious inequities in many cooperatives. Because inactive equity holders generally are not compensated with dividends or interest, they in effect subsidize the operations of the cooperative for active patrons who benefit from its services. Many of these inactive equity holders no longer have voting rights. Consequently, ownership and control are separated, and inactive equity holders do not have a voice in shaping the equity redemption policies of their cooperatives.

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n its 1979 report to Congress on cooperaives, the General Accounting Office (GAO) ecommended that unless cooperatives are villing to adopt voluntarily equity redemption programs that are more equitable, the secretary of agriculture should develop a egislative proposal that would make it mandatory for cooperatives to (1) pay interest or dividends on retained equities, (2) retire etained equities within a certain time, or (3) pay interest or dividends on retained equiies and retire retained equities within a cerain time. The GAO also suggested that, nder such legislation, cooperatives with section 521 federal income tax status that did not comply with the mandatory requirements should lose that status (Comptroller General of the United States, pp. 44–45).[1]

This article examines the potential impact on farmer cooperatives of the GAO proposals for mandatory programs of equity retirement and payment of interest on retained equity.[2] It also considers the impact of two alternative programs: (a) mandatory payment of interest on only those equities held by inactive patrons and heirs of deceased patrons and (b) mandatory retirement of retained equities held by inactive patrons and heirs of deceased patrons. The effect of these programs on the percentage of patronage refunds paid in cash, rate of growth in retained equity, and/or length of the revolving period is analyzed using a deterministic growth model. Further analysis considers use of financial leverage in meeting the requirements of mandatory equity programs.

Previous Studies

Articles in three recent issues of this *Review* have concerned the financial impact of equity retirement on farmer cooperatives. Conley and Lewis evaluated the financial obstacles to equity retirement among Illinois grain marketing cooperatives. Dahl, Dobson, and Veium studied the effect of a hypothetical mandatory equity retirement plan on the solvency and financial strength of Wisconsin farm supply cooperatives. In an article on public policy issues affecting cooperative growth, Cook, Sporleder, and Dahl discussed the results of an earlier study of mandatory retirement by Dahl and Dobson.

Conley and Lewis evaluated the financial obstacles to equity retirement among Illinois grain marketing cooperatives by comparing cooperatives that had formal equity retirement programs with those that did not. Using a methodology similar to that used earlier by Brown and Volkin in a national study, Conley and Lewis based their comparisons on four measures of financial strength. They found that the financial strength of cooperatives without programs was not significantly different from that of cooperatives with programs. Consequently, they concluded that concern about financial strength should not be an obstacle to an equity redemption program (p. 58). This conclusion was similar to that of Brown and Volkin that the usual reasons for not operating an equity retirement program, including poor financial condition, had little merit (p. 30).

Unfortunately, the results of the studies by Brown and Volkin and Conley and Lewis are of limited usefulness in understanding the effect of mandatory equity programs on cooperatives. Dividing cooperatives by those that have equity retirement programs and those that do not groups together all cooperatives with programs regardless of whether they systematically redeem large amounts of allocated equities or redeem small amounts on an irregular basis. Thus it is impossible to determine the relationship between financial strength and the amount of equity that is redeemed or to isolate the financial impact of a particular plan.

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[1] The tax treatment of farmer cooperatives and their patrons is specified in Subchapter T (sections 1381–88) of the Internal Revenue Code of 1954. In determining taxable income, cooperatives are allowed deductions for qualified patronage refunds and per-unit capital retains. Per-unit retains are equities invested by patrons based on the value or quantity of products marketed and withheld from proceeds. At least 20 percent of qualified patronage refunds must be paid in cash. The noncash portion of a qualified patronage refund or per-unit capital retain is treated as if received in cash by the patron and must be taken into account in determining the patron's taxable income. In addition to qualified distributions, cooperatives meeting the requirements of section 521 of the code are allowed deductions for dividends on their capital stock or other equity capital and nonpatronage income, such as interest and rental income, distributed to patrons on a patronage basis. In 1976, 43 percent of cooperatives held section 521 tax status (Griffin et al., p. 10).

[2] The GAO report uses both the terms "interest" and "dividends" to refer to mandatory payments to equity holders. Generally, interest is a payment for the use of borrowed capital and is considered an expense in determining net margins. Dividends are distributions of net margins to equity holders. For convenience and because of their mandatory nature, payments to holders of retained equity under the GAO proposals are called "interest" in this article and are treated as interest expense in determining net margins.

Further, the fact that the financial strength of cooperatives without equity retirement programs does not significantly differ from that of cooperatives with programs does not imply that implementation of programs will not affect financial strength. Obviously, redemption of equity can affect liquidity and solvency. Just as cooperatives with equity retirement programs might have been financially stronger if they had not adopted them, cooperatives without programs might weaken their financial conditions by adopting them. To assess the financial impact of an equity retirement program on cooperatives without programs, it is necessary to compare the financial condition of the cooperatives both before and after implementation of the program.

Dahl, Dobson, and Veium used this approach in studying the effect of a hypothetical mandatory equity retirement plan on the solvency and financial strength of Wisconsin farm supply cooperatives. Under the plan, cooperatives would be required to retire each year equity capital held by members who retire, die, or leave the area served by the cooperative. The equity retired was assumed to be replaced by long-term debt. The authors concluded that the mandatory equity retirement plan could substantially reduce the solvency and financial strength of many cooperatives (p. 39).

By focusing on the plan's effect on solvency and financial strength, Dahl, Dobson, and Veium ignored potential impacts on the level of cash patronage refunds, length of revolving period, and rate of growth. The analysis reported in this article concentrates on these latter effects of mandatory equity programs. This focus was chosen because many cooperatives could be expected to try to meet the requirements of mandatory equity programs by first lowering cash patronage refunds and because increases in leverage are probably best analyzed only after limits to growth in equity are considered. Concentration on these effects also has the advantage of illustrating the trade-offs between benefits to active patrons (cash patronage refunds and growth) and inactive equity holders (equity retirement and interest on equities).

Procedure

Analysis of the impact of the GAO proposals and the two alternative programs was conducted using a deterministic growth model used in a recent Agricultural Cooperative Service (ACS) study on equity redemption (Cobia et al.) and described in a supplementary report (Royer). In the model, the level of cash patronage refunds, length of revolving period (or percentage of equity redeemed each year), and rate of growth in equity are related to the rate of return to equity (and/or the rate of deduction of per-unit capital retains). By either setting the length of the revolving period according to a mandatory requirement or reducing the rate of return to equity according to required interest payments, the values of the other variables a cooperative could maintain under a mandatory equity program can be determined.

The impact on the percentage of patronage refunds paid in cash and on the rate of growth in retained equity of the following mandatory equity plans was evaluated for a representative cooperative: (1) 5-, 10-, and 15-year revolving periods; (2) 8 percent per annum interest on all retained equities; (3) 8 percent per annum interest on retained equities held by inactive equity holders; (4) all combinations of the above revolving periods and interest policies; and (5) retirement of retained equities held by inactive equity holders for each revolving period.

Analysis was ex post: The impact of the programs was determined by comparing the estimated level of cash patronage refunds, length of revolving period, rate of growth in retained equity, and leverage of the representative cooperative in 1976 without mandatory programs with the possibilities that would have existed under the programs. Results were validated by comparing the data used to compute them with more recent data (Richardson et al.; unpublished ACS staff reports not cited in the list of references).

stimates of the rate of return to retained quity, percent of refunds to patrons paid in ash, and rate of growth in retained equity or the representative cooperative were ased on data from ACS financial profile tudies for fiscal years 1970 and 1976 (Grifn et al.). These are the most recent ational data available for calculating the ate of return to retained equity. Although hey cover only two years, these data represent a cross-section of U.S. farmer cooperatives with respect to size, location, function, ommodity classification, and tax status.

The 8 percent per annum interest rate was chosen because a majority of agricultural cooperative incorporation statutes that restrict the dividend rate paid on patron equity limit it to 8 percent (Baarda, pp. 12–13). Also, the rate paid on patrons' equity by cooperatives holding section 521 federal income tax status is limited to the greater of 8 percent and the rate (if any) established by the cooperative's state incorporation statute.

Results

Based on the 1970 and 1976 data, the representative cooperative paid 49.0 percent of patronage refunds in cash, increased retained equity at the rate of 12.2 percent per annum, and earned a rate of return to retained equity of 22.8 percent.[3] Consequently, it would have been able to maintain a revolving period of 16.4 years.[4]

Table 1 indicates the reductions in the percentage of patronage refunds paid in cash (c) or the rate of growth in retained equity (g) that would have been necessary for the representative cooperative to satisfy the requirements of the mandatory programs considered in this study. Table 1 also indicates the reduced rate of return to retained equity (r) for programs requiring payment of interest on retained equities.

Cooperatives earning less than the average rate of return to retained equity would not have been able to maintain the same levels of cash patronage refunds and rates of growth shown in table 1. Thus demonstration that the representative cooperative may have been able to satisfy the requirements of a mandatory program is not proof that all cooperatives would have been able to do so.

Mandatory Revolving Periods

Mandatory revolving periods would ensure more timely retirement of equity, benefiting former patrons and overinvested current patrons.[5] They could also significantly reduce the flow of funds available for cash patronage refunds and growth.

Figure 1 shows the combinations of patronage refunds paid in cash and rates of growth in retained equity the representative cooperative could have maintained given its 16.4-year revolving period and 5-, 10-, and 15-year mandatory revolving periods. Point b on the 16.4-year curve represents the combination of 49.0 percent cash patronage refunds and 12.2 percent rate of growth in retained equity that could have been maintained by the cooperative without a mandatory revolving period.

Points on the 5-, 10-, and 15-year curves within the rectangle abcd represent combinations of cash patronage refunds and growth in retained equity from which the cooperative could have rationally chosen while satisfying a mandatory revolving period. To maintain a 15-year mandatory revolving period, the cooperative would have had to reduce its level of cash patronage refunds to 47.0 percent, reduce its rate of growth to 11.6 percent, or lower both

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[3] The estimated average rate of return to allocated equity acquired by retained patronage refunds and per-unit capital retains was used as the rate of return to retained equity. Because this figure is based on retained equity acquired in part by per-unit retains, the values presented in this article were calculated by taking into account the 2.7 percent estimated average rate of deduction of per-unit capital retains.

[4] In their 1974 study (published in 1977), Brown and Volkin found that the average revolving period of surveyed cooperatives using only systematic revolving fund plans was 9.1 years, but 68 percent of cooperatives had no systematic plans for retiring retained equities (pp. 5 and 9).

[5] The term "overinvested patron" is used here to mean a patron whose equity investment is disproportionately high relative to his or her use of the cooperative.

Table 1. Comparison of Cash Patronage Refunds and Rates of Growth in Retained Equity under Alternative Equity Programs (percent)

Program	Rate of Return to Retained Equity	Patronage Refunds Paid in Cash	Rate of Growth in Retained Equity
No manadatory equity program (16.4-yr. revolving period)	r = 22.8	c = 49.0	g = 12.2
		To meet mandatory requirements, cooperative must	
		lower—	or lower—[a]
Mandatory revolving period			
15-yr. revolving period	r = 22.8	c to 47.0	g to 11.6
10-yr. revolving period	r = 22.8	c to 33.8	g to 7.2
5-yr. revolving period	r = 22.8	c to 20.0 and g to 1.6	[b]
Mandatory payment of interest on all retained equities			
16.4-yr. revolving period	r = 14.8	c to 21.5	g to 6.7
15-yr. revolving period	r = 14.8	c to 20.0 and g to 11.9	g to 6.0
10-yr. revolving period	r = 14.8	c to 20.0 and g to 7.5	g to .5
5-yr. revolving period	r = 14.8	[c]	[b]
Mandatory payment of interest on retained equities held by inactive equity holders[d]			
16.4-yr. revolving period	r = 21.1	c to 44.8	g to 11.0
15-yr. revolving period	r = 21.2	c to 42.9	g to 10.4
10-yr. revolving period	r = 21.5	c to 29.8	g to 6.0
5-yr. revolving period	r = 22.0	[c]	[b]
Mandatory retirement of retained equities held by inactive equity holders			
16.4-yr. revolving period	r = 22.8	c to 35.1	g to 8.4
15-yr. revolving period	r = 22.8	c to 33.5	g to 7.9
10-yr. revolving period	r = 22.8	c to 22.2	g to 3.8
5-yr. revolving period	r = 22.8	[c]	[b]

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[a] The representative cooperative also could have met the requirements of a mandatory equity program by lowering the percentage patronage refunds paid in cash and the rate of growth in retained equity in combination or, in some cases, by increasing its revolving period. Mandatory payment of interest on retained equities held by inactive equity holders could have been made by increasing the revolving period to 20.9 years.

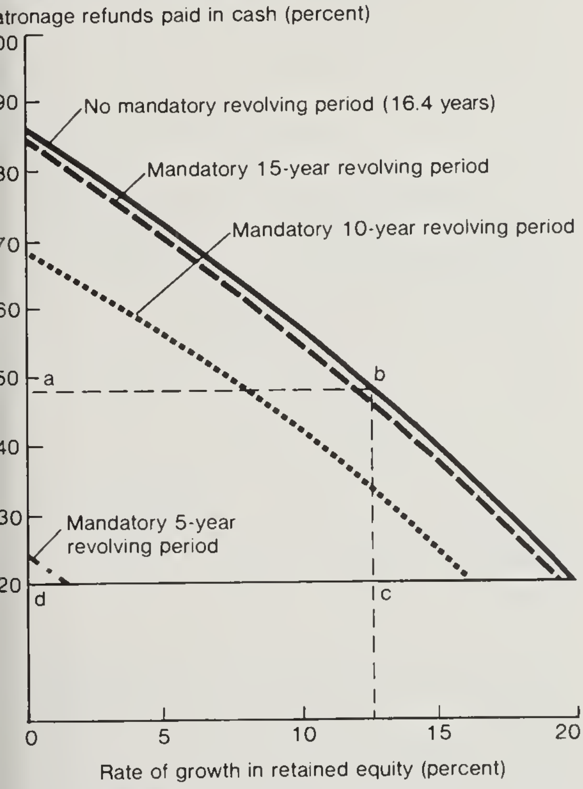
[b] A nonnegative rate of growth is not feasible given percentage patronage refunds paid in cash and length of revolving period.

[c] The 20 minimum level of cash patronage refunds and a nonnegative rate of growth are not feasible given length of revolving period.

[d] The rates of return to retained equity for mandatory revolving periods are for reductions in the percentage patronage refunds paid in cash. Rates of return for reductions in the rate of growth in retained equity differ slightly.

gure 1

asible Combinations of Cash Patronage Refunds and owth in Retained Equity Under andatory Revolving Periods



ash patronage refunds and growth in comination. Shorter revolving periods would ave required greater reductions in the level f cash patronage refunds and/or rate of rowth.

Jnless active patrons were willing to accept ower levels of cash patronage refunds to neet the shorter revolving period, the cooperative's rate of growth would have had to e significantly decreased. Even at modest ates of inflation, mandatory revolvement rograms could have resulted in negative eal rates of growth. To maintain a 10-year evolving period without reducing the level of cash patronage refunds, the cooperative vould have had to decrease its nominal rate of growth to 7.2 percent. The cooperative vould not have been able to maintain a mandatory 5-year revolving period and still pay the 20 percent minimum level of cash patronage refunds without reducing its rate of growth to 1.6 percent.

This rate of growth is substantially less than the 7.3 percent necessary to offset inflation between 1970 and 1976.[6] To avoid erosion of its capital base while paying 20 percent cash patronage refunds and meeting a 5-year revolving period, the cooperative would have had to increase borrowing. The average interest rate charged by the banks for cooperatives (BCs) on term loans July 1, 1976, was 7.67 percent. Using this as the interest rate on new loans, the cooperative would have had to replace 23.0 percent of retained equity with term debt, thereby increasing its ratio of total debt to equity from 1.40 to 1.90.

Mandatory Payment of Interest on Retained Equities

Mandatory payment of interest on retained equities would benefit inactive equity holders by compensating them for use of their capital. In addition, according to the GAO, mandatory payment of interest would provide an economic incentive for cooperatives to retire equities on a more timely basis (Comptroller General of the United States, p. 43). This program could actually result in longer revolving periods, however, because of reduced cash flow.

At the end of the fiscal year 1976, cooperatives held $5.9 billion in allocated equity acquired by retained patronage refunds and per-unit capital retains (Griffin et al., p. 49). If a provision requiring cooperatives to pay 8 percent interest on retained equities was enacted, annual interest expense to cooperatives could have increased by as much as $468.6 million. This would have reduced net margins available for cash patronage refunds and equity retirement by 30.0 percent.

Longer revolving periods, lower levels of cash patronage refunds, or lower rates of growth in retained equity would have had to accompany this reduction in net margins. To meet the increased interest expense caused by mandatory payment of interest on retained equity without lengthening its revolving period, the representative cooperative would have had to lower cash patronage refunds from 49.0 percent to 21.5 percent or lower its rate of growth from 12.2 percent to 6.7 percent.

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[6] The compound rate of inflation between 1970 and 1976 was 7.3 percent, based on the fixed-weighted price index for the nonresidential fixed investment component of gross private domestic investment.

Both GAO Mandatory Programs

To meet both mandatory payment of interest and a mandatory revolving period, the representative cooperative would have had to lower cash patronage refunds and/or its rate of growth substantially, as shown in table 1. The cooperative would not have been able to pay interest on retained equities and maintain a 5-year mandatory revolving period without increasing borrowing. To meet these programs and avoid capital erosion caused by inflation while paying 20 percent cash patronage refunds, the cooperative would have had to replace 45.3 percent of retained equity with term debt. This would have increased its debt/equity ratio from 1.40 to 2.65.

Mandatory Payment of Interest on Retained Equities Held by Inactive Equity Holders

An alternative to mandatory payment of interest on all retained equities is required payment of interest on only those equities held by inactive patrons and heirs of deceased patrons. With this policy, the financial burden on cooperatives would be significantly reduced, yet former patrons and estates still would be compensated for holding equity. This policy would also focus attention within cooperatives on the importance of retiring the equities of inactive patrons and provide them an incentive for doing so.

According to Brown and Volkin, 22 percent of the allocated equity of centralized cooperatives surveyed in 1974 was held by inactive equity holders (p. 21). Given this figure, mandatory payment of interest on retained equities held by inactive patrons and heirs would have required a smaller reduction in the level of cash patronage refunds or rate of growth than mandatory payment of interest on all retained equities, as shown in figure 2. If the representative cooperative were required to pay interest on only those equities held by inactive patrons and heirs, it would have had to lower its cash patronage refunds from 49.0 percent to 44.8 percent instead of 21.5 percent or reduce its rate of growth from 12.2 percent to 11.0 percent instead of 6.7 percent.

Mandatory payment of interest on retained equity held by inactive equity holders would also require smaller reductions in cash patronage refunds and growth if combined with mandatory revolving periods, as shown in table 1.[7] The representative cooperative would not be able to pay interest on retained equity held by inactive equity holders and maintain a 5-year revolving period without increasing borrowing. To meet these programs and avoid capital erosion caused by inflation while paying 20 percent cash patronage refunds, the cooperative would have had to replace only 23.0 percent of retained equity with term debt. This would have increased its debt/equity ratio from 1.40 to 1.90, considerably lower than required under mandatory payment of interest on all retained equities.

Mandatory Retirement of Retained Equities Held by Inactive Equity Holders

A second alternative to the mandatory equity programs proposed by the GAO would be mandatory retirement of retained equities held by inactive equity holders. Under this program, active patrons would supply all of the equity used to finance the services provided by the cooperative.

According to the model, if inactive equity holders held 22 percent of total retained equity of the representative cooperative, each year 4.0 percent of the equity would have been held by patrons who would become inactive during the year. This value was used to compute the reductions in the percentage of patronage refunds paid in cash and rate of growth in retained equity necessary for the representative cooperative to satisfy this program in table 1.[8]

As shown in table 1 and figure 2, the retirement of retained equities held by inactive igure 2

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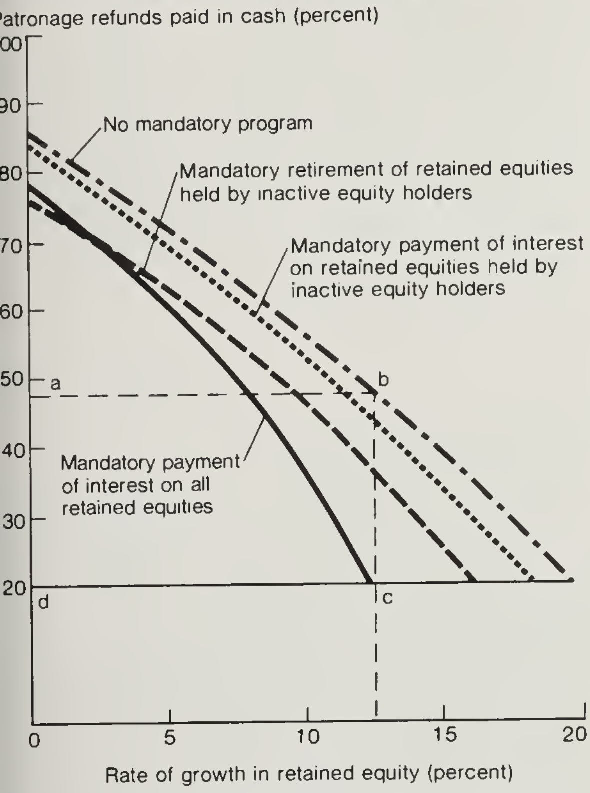
[7] If mandatory payment of interest on retained equity held by inactive equity holders was combined with a mandatory revolving period of less than 16.4 years, earlier revolvement of equity would reduce the proportion of equity held by inactive patrons and heirs. This was taken into account in computing the figures in table 1. If the rate of growth in retained equity remained the same, the percentage of equity held by inactive equity holders would fall to 10.6, 16.5, and 20.6 percent respectively for 5-, 10-, and 15-year revolving periods. But the impact would be minor, as indicated by the small differences in the rates of return to retained equity in table 1.

easible Combinations of Cash Patronage Refunds and rowth in Retained Equity Under Alternative Mandatory quity Programs and 16.4 -Year Revolving Period



equity holders would have required less of a reduction in the percentage of patronage refunds paid in cash and/or rate of growth in retained equity than mandatory payment of interest on all retained equities but more than mandatory payment of interest on only those retained equities held by inactive equity holders.

The representative cooperative would not have been able to retire the equities held by inactive equity holders and maintain a 5-year mandatory revolving period without increasing borrowing. To meet these programs and avoid capital erosion caused by inflation while paying 20 percent cash patronage refunds, the cooperative would have had to replace 31.3 percent of retained equity with term debt, which would have increased its debt/equity ratio from 1.40 to 2.14.

Table 2. Increase in Rate of Return to Retained Equity Resulting from Debt Leveraging (percent)

Increase in Term Debt (percent)	Rate of Return to Retained Equity	Rate of Growth in Retained Equity[a]	Debt/Equity Ratio
0	14.8	5.8	1.40
25	17.5	7.7	1.71
50	21.5	10.4	2.12
75	27.6	14.3	2.67
100	38.6	20.7	3.46

[a] Given 50 percent level of cash patronage refunds and 15-year revolving period.

Use of Leverage

Cooperatives that have unused borrowing capacity might be able to offset some of the impact of mandatory equity programs by substituting term debt for retained equity. At the end of fiscal year 1976, cooperatives held $3.6 billion in term debt (Griffin et al., p. 29). The representative cooperative had a ratio of total debt to equity of 1.40. If 8 percent per annum interest on retained equities is assumed, the cooperative would have had a 14.8 percent rate of return to retained equity. This rate of return would have allowed the cooperative only a 5.8 percent rate of growth in retained equity given 50 percent cash patronage refunds and a 15-year revolving period.[9]

Table 2 shows the increases in the cooperative's rate of return to retained equity, rate of growth in retained equity, and debt/equity ratio resulting from replacement of retained equity with term debt. By increasing term debt by 25 percent (which would allow a 15.3 percent reduction in retained equity), the cooperative would have been able to increase its rate of return to 17.5 percent and thereby its rate of growth to 7.7 percent. This action would have increased its debt/

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[8] Dahl, Dobson, and Veium estimated that for 1966–74 between 8.48 and 9.14 percent of equity in Wisconsin farm supply cooperatives was held by members who retired, died, or left cooperatives each year (p. 32). These figures were not used in this analysis because, according to the model, they would imply that between 38.8 and 40.9 percent of retained equity was held by inactive equity holders.

[9] Use of 50 percent cash patronage refunds and a 15-year revolving period is not entirely arbitrary. The original bill for the Tax Reform Act of 1969 included provisions that would have required cooperatives to pay 50 percent of qualified patronage refunds in cash and to redeem the noncash portions of qualified patronage refunds and per-unit capital retains within 15 years of allocation.

Table 3. Comparison of Rates of Return, Rates of Growth, Interest Rates, and Debt/Equity Ratios (percent)

Estimate	1970/1976	Year(s) 1977/1979/1980	1981
Average rate of return to total assets	8.9	7.7	4.9
Average rate of return to total equity	19.0	17.7	12.8
Compound rate of growth in total assets	13.9	15.8	– 2.0
Compound rate of growth in total equity	11.8	9.5	3.1
Average interest rate on term loans charged by BCs July 1 of last year in period	7.67	12.35	14.10
		Ratio	
Debt/equity ratio at end of last year in period	1.40	1.78	1.64

Source: Computed from Richardson et al., unpublished ACS staff reports, and data supplied by Farm Credit Administration.

equity ratio to 1.71. Greater increases in term debt shown in table 2 would have further increased the rate of return but would have also resulted in higher debt/equity ratios.[10]

Comparison with Recent Data

Although data necessary for computing the rate of return to retained equity do not exist for fiscal years after 1976, more recent data are available for computing estimated rates of return to total assets and total equity (Richardson et al.; unpublished ACS staff reports not included in list of references). These rates, estimated compound rates of growth in total assets and total equity, average interest rates on BC term loans, and debt/equity ratios for 1977, 1979, 1980, and 1981 are compared to corresponding data for 1970 and 1976 in table 3.

The average estimated rates of return to total assets and total equity were lower in the period from 1977 to 1980 than in 1970/1976 and fell significantly in 1981. Preliminary data indicate that these rates will be even lower for 1982.

Recent rates of growth in total assets have been higher than for 1970/1976 (except for 1981 when there was a decline in assets). The rate of growth in total equity, however, has declined since 1976 and has been lower than the rate of growth in total assets. This decline is reflected in the debt/equity ratio, which has risen from 1976 until 1981.

The lower rates of return to total equity probably have been accompanied by lower rates of return to retained equity. Thus cooperatives probably would have had a diminished ability to pay cash patronage refunds and sustain growth in retained equity under mandatory equity programs.

Although cooperatives have generally increased their leverage since 1976, the rate of return to total equity has declined, probably because of the effects of rising interest rates and lower returns on assets. The ability of cooperatives to take on more debt in the future to increase their rates of return and improve their ability to service equity may be compromised because many cooperatives may be approaching limits to their borrowing capacity (as evidenced by the debt/equity ratios in table 3). Further, the borrowing that can take place may be necessary for ontinued growth in assets (as indicated by ne greater rate of growth in total assets than n total equity in recent years).

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[10] Recent higher interest rates would have substantially reduced the ability of cooperatives to meet mandatory equity programs through increased leverage. Given the average July 1, 1981, BC interest rate on term loans of 14.10 percent, a 25 percent increase in term debt would have increased the representative cooperative's rate of return to 16.4 percent and its rate of growth to 6.9 percent.

.ower rates of return to equity, higher rates of growth, increased leverage, and the finanially difficult years of 1981 and 1982 all ndicate that cooperatives would have been ess able to satisfy the requirements of manlatory equity programs recently than they vere between 1970 and 1976. As a result, his study may be conservative in estimating he impact of mandatory equity programs.

Conclusions

Aandatory revolving periods would ensure nore timely retirement of equity, benefiting ormer patrons and overinvested current oatrons, but they would also significantly educe funds available for cash patronage efunds and growth. Mandatory payment of nterest on retained equities would benefit nactive equity holders by compensating hem for use of their capital. In addition, ccording to the GAO, mandatory payment of interest would provide an economic ncentive for cooperatives to retire equities on a more timely basis. This program would also reduce funds available to cooperatives and could actually result in longer revolving periods.

An alternative to mandatory payment of interest on all retained equities is required payment of interest on only those equities held by inactive patrons and heirs of deceased patrons. With this policy, the financial burden on cooperatives would be significantly reduced, yet former patrons and estates still would be compensated for holding equity. A second alternative would be mandatory retirement of retained equities held by inactive equity holders. This alternative would place more financial burden on cooperatives than mandatory payment of interest on retained equities held by inactive equity holders but less than mandatory payment of interest on all retained equities.

The primary disadvantage of mandatory equity programs is the loss of financial flexibility cooperatives would incur. Equity capital usually serves as the basis for credit and a buffer for creditors should the business experience operating losses or shrinkage in asset values. Without mandatory equity programs, a cooperative that encounters a series of difficult years can temporarily slow down retirement of equity or payment of dividends on retained equity until it regains its financial strength. Under mandatory equity programs, however, the cooperative would be required to service equity in a manner similar to debt, diminishing its capacity to absorb the uncertainties of the business environment. In addition, concern among lenders, who might view the commitment to service equity as a threat to cooperatives' ability to service debt, could reduce the availability of credit.

Some cooperatives might be able to meet the requirements of mandatory programs by accumulating additional equity capital through direct investments, increased retained patronage refunds, per-unit capital retains, or by substituting debt for redeemed equity. Despite the best intentions of membership and management, however, other cooperatives might not be able to generate cash flow adequate to replace redeemed equity. Exceptions to mandatory programs could be made for financially weak cooperatives, but definition and enforcement of rules for determining exceptions would be difficult.

Because of the threat of mandatory equity programs, cooperatives need to do a better job of retiring and servicing patrons' equity if they are to maintain flexibility in managing their financial affairs. At a minimum, cooperatives should consider voluntarily retiring the equities of inactive equity holders or paying dividends on these equities until they are redeemed.

Cooperatives should also consider adopting comprehensive programs of equity formation and redemption that can be used in financial budgeting and planning.[11] Difficulty in implementing and maintaining a program may be an indication that current patrons are not contributing adequate amounts of equity. If current patrons are unwilling to finance the cooperative without relying on free capital provided by inactive equity holders, they may need to consider whether the services provided by the cooperative are necessary.

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[11] For detailed discussion of alternative plans for equity formation and redemption, see Cobia et al., pp. 21–56.

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Cooperative Equity Redemption Plans and Financial Strength: New Empirical Evidence

Mark D. Newman

Abstract

This article examines specific types of equity redemption policies and associated financial performance of Kansas grain marketing and supply cooperatives. Policies are evaluated at a more disaggregated level than in previous work. Significant differences in size, inactive membership, solvency, financial leverage, and profitability are identified.

Cooperatives maintaining revolving fund programs were significantly stronger than all others, although cause and effect were not identified. This study concludes that, although many cooperatives have been able to adopt policies for equity redemption, financial strength of cooperatives differs sufficiently that specific types of mandatory equity redemption would cause problems for some cooperatives.

Key words: cooperatives, cooperative equity, cooperative finance, equity redemption.

Introduction

In recent years there has been considerable discussion of whether patronage and ownership of cooperatives by their members have been close to proportional, a practice basic to cooperative principles. Equity investments of farmers who stop using cooperatives have not always been redeemed or adjusted downward and replaced by equity capital from current users (Brown and Volkin). A Government Accounting Office (GAO) report has suggested that cooperatives remedy this situation voluntarily or that legislation mandate either redemption or dividend payments on retained equities (GAO). As the average age of cooperative members becomes increasingly older, equity redemption—recently characterized as a "ticking time bomb" facing cooperatives (Ginder)—remains a major public policy issue.

A number of studies have attempted to document equity redemption policies of cooperatives (Brown and Volkin; Conley and Lewis; GAO) and evaluate the impact of mandatory equity redemption on cooperative financial strength (Conley and Lewis; Cook; Dahl, Dobson, and Veium, 1981, 1982). Two previous studies published in *Agricultural Finance Review* reached conflicting conclusions on the impact of mandatory redemption. Conley and Lewis concluded that "grain cooperatives without equity redemption programs did not have significantly more difficult financial obstacles to equity redemption than did cooperatives with such programs." Dahl, Dobson, and Veium, on the other hand, concluded

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that mandatory equity retirement could substantially reduce the solvency and financial strength of many Wisconsin farm supply cooperatives.

Previous studies have hypothesized impacts of specific mandatory equity redemption programs on cooperative financial strength. In contrast, this article provides new empirical evidence on equity redemption programs and associated financial performance. Programs are disaggregated to a level not available in previous work. Although it is not possible to prove causal relationships between types of equity retirement programs and financial performance, the evidence presented here is descriptive and suggestive. Such evidence gives focus to questions regarding cooperative financial performance and control, and it suggests the potential impact of mandatory equity redemption. Possible reasons for contradictory findings are also discussed.

Study Procedures

In November 1981 a questionnaire was mailed to managers of all 241 grain marketing and supply cooperatives in Kansas. Managers were asked to answer questions and to supply financial data equivalent to balance sheets and income statements for a two-year period. Such data are generally distributed at cooperative annual meetings. A follow-up letter was sent, and an announcement urging completion of the questionnaire appeared in the newsletter of the Kansas Cooperative Council. The response rate of completed questionnaires was 32 percent.

A telephone survey was then taken of a 20 percent random sample of nonrespondents using an abridged questionnaire. There was a 96 percent response rate to the telephone survey, and 80 percent of respondents provided financial data. In case of statistically significant differences in characteristics of respondents and nonrespondents to the original survey, such as variables related to size and types of equity redemption policies, a weighting procedure was employed using telephone survey data to estimate nonrespondents' attributes. Otherwise, data from the two surveys were pooled. Financial data evaluated here are for fiscal years ending during the July 1, 1980–June 20, 1981, period. This period was selected to coincide with a single wheat marketing year. Nonresponse bias in this survey and the weighting procedure used are discussed elsewhere (Newman; Newman and Stephens). Overall, 45 percent responded to either the initial survey or telephone follow-up and 37 percent provided financial data.

Equity Redemption: Kansas in Perspective

As user-owner businesses, farmer cooperatives are taxed according to a single tax principle that looks through the cooperative to tax the joint user-owners, who in principle receive all of the benefits. To qualify for single tax treatment, cooperatives must allocate their profits, called savings in cooperatives, to their patron/owners on an annual basis so that they are taxed at the level of the individual member. In addition, for single tax treatment at least 20 percent of these savings must be distributed in cash and the rest in stock certificates, equity certificates, or equity ledger credits. The noncash allocation then constitutes an ownership interest in the cooperative on which the member becomes liable for taxes. Retained patronage refund allocations are one way that cooperatives build equity capital (Beierlein and Schrader; Fenwick). Equity redemption or retirement is the process by which the equity ownership interests of individual members are redeemed. Maintenance of a strong cooperative requires that redeemed equity be replaced by equities from other users. Therefore, equity redemption is one facet of overall equity management.

Cooperatives that redeem equities follow several approaches including retirement: (1) exclusively to the estates and deceased members; (2) in "special" circumstances such as when farmers move away from the community, stop farming, or stop patronizing the co-op; (3) when patrons reach a predetermined age; (4) on a first-in, first-out revolving fund basis; (5) according to equity ownership in excess of the proportion of total business accounted for by the member (base capital plan); or (6) on a straight percentage basis. These approaches are described in greater details in Cobia et al. Only the first four approaches are widely used in Kansas.

Most of the empirical evidence on equity retirement in cooperatives has been based on work by Manuel in Kansas in the 1950s, a 974 national survey by Brown and Volkin, and a 1978 survey in Illinois by Conley and Lewis. The more recent studies make very limited distinctions among types of equity redemption plans used by cooperatives. Brown and Volkin categorize cooperatives as having systematic, special, or no programs. Conley and Lewis distinguish only between cooperatives with and those without programs. The study reported in this paper sought further to disaggregate equity retirement plans and associated financial performance. It was hypothesized that such an analysis could add new insights to discussions of the state of cooperative equity redemption and the impact of mandatory equity redemption on cooperative financial strength. Results of this study provide sharp contrast to Manuel's finding that in 1950 only 10 percent of all cooperatives had adopted some policy for equity retirement. n 1981 more than 99 percent of Kansas cooperatives reported a policy to redeem equities. This percentage is the highest reported in the literature to date. Almost all cooperatives redeem equities belonging to estates, but 13 percent redeem only to settle estates. Twenty-four percent have either an estate settlement program or a combination of estate settlement and a "special" program. Forty-four percent redeem the equities of those who stop farming, and 52 percent redeem equities of those who move away from the community. Twenty-three percent of all cooperatives have a revolving fund for equity retirement. Sixty-four percent of all cooperatives have an age retirement program but no revolving fund. Only 13 percent employ a revolving fund exclusively. (These numbers do not add to 100 percent because many cooperatives employ multiple programs.)

Age-based retirement programs are probably more prevalent in Kansas than in some other states because the largest federated regional cooperative with membership in the state retires ownership equities to local cooperatives on the basis of age of local members. This policy provides a strong incentive for locals to employ an age-based program.

Equity Retirement Programs and Financial Performance

Size, financial performance, and variability were examined across the range of equity redemption policies used by Kansas cooperatives. The study provides insights into financial strength associated with cooperatives employing specific policies and indicates potential obstacles to the adoption of more systematic procedures by cooperatives with restricted programs.

This article emphasizes comparisons between financial performance of cooperatives falling into each of three equity retirement policy categories and all other cooperatives. Table 1 summarizes mean values for all cooperatives and cooperatives with policies that provide for (1) estate settlement and/or redemption under special circumstances (except age); (2) redemption based on age, either alone or in conjunction with any other factor; and (3) redemption according to a revolving fund, either exclusively or in conjunction with some other program. Results of further disaggregation are reported in the text below.

Tests of the null hypothesis that mean values of individual characteristics are equivalent for cooperatives with a given equity redemption policy and all other cooperatives were conducted. In cases in which it was concluded that variances in each population are equivalent using an F-test, a standard t-test was used to draw inferences concerning equivalence of means. If variances were concluded to be unequal on the basis of an F-test, an approximation of a t-test was employed. T-tests for small sample sizes are based on the assumption that samples are drawn from populations that are normally distributed for the characteristic under study. Such an assumption is required to draw inferences based on groupings of equity redemption policies at a more disaggregated level than presented in table 1. It is also required for inferences reported in at least the study by Conley and Lewis.

Table 1. Size, Financial Performance, and Equity Retirement Policies of Kansas Cooperatives, 1980—81[a]

Variable	Equity Retirement Policy Category			All Cooperatives
	Estate Settlement and/or Special Circumstances	Age-Based and Any Other	Revolving Fund and Any Other	
Total assets ($)	2,010,084	4,878,864	4,147,869	3,511,376
	(.0001)	(.005)	(.94)	
Total sales ($)	5,467,696	11,625,915	10,430,409	8,770,121
	(.0002)	(.009)	(.89)	
Number of members	915	1,320	1,095	1,098
	(.24)	(.15)	(.56)	
Inactive members (%)	24.0	19.4	18.1	21.0
	(.13)	(.62)	(.45)	
Cash patronage dividends (%)				
1980	24	30	31	26
	(.02)	(.29)	(.15)	
1981	24	29	32	25
	(.04)	(.42)	(.09)	
Equity/assets	.57	.55	.63	.58
	(.97)	(.12)	(.04)	
Current ratio	2.07	1.56	1.88	2.04
	(.39)	(.05)	(.61)	
Total debt/equity	.88	.98	.68	.84
	(.83)	(.07)	(.01)	
Long-term debt/equity	.32	.25	.16	.24
	(30)	(.72)	(.001)	
Local operating margin (%)	1.80	1.82	3.06	1.78
	(.71)	(.33)	(.03)	
Return on assets (%)	9.28	9.07	11.80	10.09
	(.68)	(.10)	(.09)	
Return on equity (%)	14.99	16.10	18.73	16.54
	(.34)	(.46)	(.19)	
Total savings generated locally (%)	52	47	49	49
	(.77)	(.30)	(.99)	
Cooperatives reporting policy (%)[b]	24	64	23	100

[a] Figures in parentheses represent p-values for tests of significance of differences from other cooperatives.

[b] Percentages sum to more than 100 because cooperatives fall into multiple categories.

In hypothesis testing it is common practice to select arbitrarily a maximum .10 probability of type I error (concluding that a difference in population characteristics exists when it does not) for presentation of differences as statistically significant. Nonetheless, for many purposes conclusions of differences with a .11, .20, or greater probability of type I error would be of equal interest to researchers concerned with equity redemption issues. For this reason, p-values are presented in table 1. These are the actual or approximate probability of type I error if it is concluded that mean values differ for cooperatives with a given policy and all others. This complicates the process of identifying differences as "statistically significant" but provides readers with more information with which to interpret findings. It is also in line with current thinking in the statistics literature.

Estate Settlement and Special Cases

Cooperatives providing for redemption of equities only to estates or in special cases (E/S) as defined above can be classified as the least systematic in their abilities to plan for equity redemption expenditures. In comparison to others, E/S cooperatives had smaller asset bases, smaller total sales volumes, smaller numbers of members, and a higher percentage of inactive members. These cooperatives also paid a lower perentage of patronage dividends in cash than ther cooperatives. These differences were iost significant for cooperatives settling states only.

ooperatives in the E/S group did not differ reatly from others in overall financial trength although their long-term debt obliations as a share of members' equity were ouble the ratio for cooperatives with evolving funds. Average current ratios, solency ratios, and financial leverage are ithin ranges generally accepted as indicatng sound financial condition. Nonetheless, ong-term debt service requirements pose a otential problem for some E/S cooperaves. Borrowing to finance equity retirement rogram development could exacerbate this reat. Twenty-nine percent of E/S cooperaves had more debt than equity, while 11 ercent had long-term debt obligations mounting to more than .5 of member quity.

ocal operating margins, net savings generted at the local (compared to regional) ooperative level, as a percentage of total ales, are one measure of profitability. They ere not significantly different for cooperaves with less systematic equity retirement olicies than for others. Though sample neans for returns on assets and equity were elow those for other cooperatives, the diferences are not large enough to infer signifcant differences between groups. In the ample, profitability was slightly lower for ooperatives with "special" programs than or those without such programs. In general can be argued that factors associated with ash flow and financial leverage affect the bility of some cooperatives to adopt more ystematic programs but do not limit the bility of all E/S cooperatives to do so.

Age-Based Equity Redemption

Redemption programs based on age of the ooperative member have been termed special" equity redemption programs in ast studies (Brown and Volkin). In Kansas, he primary regional cooperative in which ocal cooperatives hold ownership interest s Farmland Industries. Farmland instituted an ownership retirement program early in he 1970s, basing redemption of local cooperative equity in the region on the age of members of local cooperatives. If a local cooperative systematically retires the equities of members aged 65 or above, Farmland will redeem a share of those equities to the local proportional to the share of local equities invested in Farmland (provided that Farmland's profits permit it). Because this program has been interpreted to require that equity redemption at the local cooperative level be based on age, many cooperatives in Kansas have adopted an age-based program, at least for the record, and often in conjunction with other forms of equity retirement policies. Sixty-four percent of all cooperatives have age-based retirement programs, either exclusively or in combination with revolving funds, special programs, or estate settlements.

Age-based equity redemption programs permit cooperatives to hold the equity investments of members for long periods of time. At recent interest rates, the net present value of retained patronage dividends to many younger members under age-based programs approaches zero and, once taxes are paid, can become negative. Supporters of age-based retirement programs often argue that cooperatives on such programs tend to pay a higher percentage of patronage dividends in cash to compensate for this shortcoming. Survey results do not provide strong support for this view. Cash patronage dividends paid by responding cooperatives using age-based retirement programs were larger than those for cooperatives as a whole but smaller than those paid by cooperatives on revolving fund programs.

Cooperatives using age-based programs are significantly larger than other cooperatives in total assets and total sales. Among those responding to the survey, however, there was no perceptible difference in membership size.

Age retirement programs are sometimes criticized because they may not maintain ownership interest in the hands of current users of the cooperative if members become inactive (stop using the cooperative) before the retirement age established for equity redemption. Membership inactivity among those cooperatives responding was not sufficiently below the mean for all cooperatives to infer a significant difference. Membership inactivity, reported at 19.4 percent, was still high. This figure is very close to the 18.6 percent membership inactivity rate reported by Manuel in 1950.

Despite the criticism mentioned above, for cooperatives with no equity redemption policies, the adoption of an age-based program is an important improvement. Furthermore, if members steadily increase their use of the cooperative until they reach the target retirement age, they could be expected to maintain a share of capital in the cooperative proportional to use as a result of retained patronage allocations. Imbalances will remain between younger members and older members who have decreased their use of the cooperative.

Previous studies have not evaluated the financial characteristics and performance of cooperatives that use age-based equity retirement policies. Analysis of the financial ratios for solvency, liquidity, debt obligations, and profitability of cooperatives responding to the survey indicate that those using age retirement programs did not perform as well as others. The ratio of owner equity to total assets was smaller for cooperatives on age-based plans than for others, though still within acceptable ranges. Liquidity or working capital, represented by the current ratio, was significantly below that for all other cooperatives and approached the lower bound of an acceptable range. The ratio of total debt to equity and the ratio of long-term debt to total equity were slightly higher than average compared to other cooperatives—the former sufficiently so to permit inference of significant difference.

Thus cooperatives using age retirement programs were somewhat less solvent and significantly less liquid with a somewhat greater overall debt burden than cooperatives without such programs. The available data do not permit evaluation of whether these factors are the result of adoption of an age-based retirement program or merely associated with the type of cooperative that is most likely to adopt such a program. They do indicate that cooperatives using age-based retirement programs should carefully evaluate their annual equity retirement decisions in the context of implications for solvency, liquidity, and use of financial leverage.

Profitability is another important measure of the ability of local cooperatives to continue to redeem the equity of inactive members. For cooperatives with an age-based program in conjunction with any other, profitability measured by return on assets (9.07 percent) was significantly different from that of other cooperatives. For cooperatives with either an age-based or "special" program but without revolving funds, local operating margins (1.56 percent) and return on assets (8.90 percent) were significantly different from those of all other cooperatives, although returns on equity were not. The latter group of age-program cooperatives is most comparable to cooperatives with "special" programs reported on by Brown and Volkin.

It was hypothesized that weak margins at the local level would tend to increase dependence on regional cooperative participation to implement equity retirement programs. This could strengthen incentives for locals to adopt a policy permitting participation in regional ownership retirement. The observed difference in the percentage of total net savings made up by local net savings was not great: 47 percent for the age-based group and 49 percent for all cooperatives.

Revolving Fund

A final group of cooperatives studied maintain a revolving fund either alone or in combination with some other equity retirement policy. They were not significantly different in total assets, total sales, or total membership from other cooperatives. Among those responding, the percentage of inactive members was slightly smaller than for other cooperatives, but this difference was not statistically significant. Cash patronage dividends paid were higher in 1980 and 1981 than for other cooperatives, averaging 31 to 32 percent.

The solvency, liquidity, and financial leverage of cooperatives with revolving funds were significantly stronger than for others. Owner equity averaged 63 percent of total assets for those with revolving funds in combination with any other program and 68 percent for those with revolving funds exclusively. Liquidity was significantly better for those exclusively on a revolving fund with urrent assets 2.29 times current liabilities. nancial leverage, measured by total debt net worth and term debt to net worth, was so significantly smaller. Cooperatives on volving funds exclusively average 50 per- ent debt to equity and 17 percent long-term ebt to equity; this compares with 84 per- ent debt to equity for all cooperatives and percent long-term debt to equity for all ooperatives.

ofitability levels were also higher for coop- atives on revolving funds. Local operating argins of 3.06 percent for those on revolv- g funds in combination with other pro- ams were almost double the margins otained by other cooperatives. Locally gen- ated savings appear to have been central the ability to maintain a revolving fund in e past and can be expected to continue to e so in the future. It was not possible to scern whether higher local margins esulted from higher prices to members or om more efficient operation. Returns on ssets and returns on equity were also gher, averaging 20.8 percent for coopera- ves with only a revolving fund and 18.7 ercent for those combining revolving funds ith other programs. Although the results eported above indicate a statistically signifi- ant association between revolving funds nd financial performance that is better than at of other cooperatives, they do not nec- ssarily imply that adoption of a revolving und leads to improved financial perform- nce. A more plausible explanation might e that only the strongest cooperatives have een able to maintain a revolving fund in e face of inflationary capital requirements uring the past decade. Some observers rgue that maintaining revolving funds will e even more difficult in the future.

onclusions

ompared with the situation found by Man- el in 1950, the present study found that ooperatives in Kansas have made impor- ant strides toward the development of quity redemption programs to maintain wnership by current users. The results of e study underscore the essential linkage etween financial strength and the ability to edeem equities in a systematic fashion. ontrary to findings projected by some pre- ious studies, adoption of equity retirement programs has not impaired the financial health of many cooperatives in Kansas. At the same time there is evidence that imposition of more systematic equity redemption programs would place a financial strain on some cooperatives in Kansas that are already taxed by limited liquidity and excessive financial leverage. The ability to disaggregate equity redemption plans and compare financial performance of cooperatives with and without individual policies provides insights not previously available when examining only the presence or absence of undefined equity redemption programs. There remains, however, considerable opportunity to seek greater precision in understanding linkages between equity management, financial performance, and the ability to maintain ownership by members in proportion to use of the cooperative.

In undertaking this study, it was expected that revolving fund programs would be the most effective in maintaining the burden for supplying ownership capital with current users of the cooperative. It was also expected that cooperatives with age-based equity redemption programs would be less effective. Analysis of this factor indirectly through reported percentages of inactive members failed to identify significant differences between each of the two groups and all other cooperatives. Furthermore, analysis of the distribution of members' ages and equity holding by age categories failed to indicate significant differences between cooperatives on revolving funds and cooperatives with age-based equity redemption programs. Cooperatives on revolving funds reported 23 percent of their members age 65 or over holding 24 percent of equity ownership in the cooperative, while those with age-based programs reported 22 percent of members age 65 or over holding 22 percent of their equity. Based on these findings, it is not possible to conclude that there are strong differences between cooperatives with revolving fund and age-based equity retirement programs in conforming to the principle that ownership in cooperatives should be proportional to their use. But in terms of solvency, financial leverage, and local operating margins, cooperatives operating revolving funds were significantly stronger than others.

Cooperatives that redeem equities to estates of deceased members either exclusively or in combination with one or more special cases such as moving away from the community, quitting farming operations, or becoming inactive were smaller than others in assets, sales, and membership. They also had a larger percentage of inactive members and paid a significantly smaller portion of patronage dividends in cash. Otherwise, financial performance as measured by solvency, financial leverage, and profitability was not significantly different from that of cooperatives with other types of equity redemption programs.

Compared with other cooperatives, however, the E/S group has an older membership holding a larger share of equity ownership. Thirty percent of members were reported to be age 65 or older, and they held 34 percent of owner equity in the cooperative. These factors indicate that equity redemption is likely to pose a major problem for E/S cooperatives in the future. Even though they have a policy to handle equity redemption, E/S cooperatives will require significant growth or borrowings to be able to retire equities belonging to estates and in other special cases as they arise. This, then, is the "ticking time bomb" mentioned earlier.

How do the results of this study relate to those reported previously? First, they confirm Brown and Volkin's contention that cooperatives can establish a policy for equity redemption. Almost all Kansas cooperatives have adopted a policy to provide for equity redemption, although many involve reaction to special circumstances rather than systematic planning for replacement of equity capital investments of old users with those of current users. In 1950, only 10 percent reported a policy (Ginder).

Second, there is support for Dahl, Dobson, and Veium's conclusion that mandatory equity redemption could impose a financial strain on some cooperatives, especially if the mandatory program obliged more systematic approaches than are currently practiced. The Kansas cooperatives in the strongest financial positions have the most systematic equity redemption programs. It is not possible to tell whether good financial conditions cause the equity retirement policy or vice versa, but they certainly would facilitate such policies.

Although some observed aspects of financial performance support Conley and Lewis's finding that financial performance is unrelated to equity redemption policy, potential impediments to equity redemption were also identified. As has been pointed out elsewhere (Newman and Stephens), nonresponse bias in Conley and Lewis's survey might explain some of the financial strength they observed, especially if cooperatives in the strongest financial condition were the most likely to respond to the survey. The extent to which this was the case cannot be confirmed without sampling those that failed to respond to the survey.

In conclusion, mandatory equity retirement remains less desirable than initiatives by cooperatives to maintain ownership by current users. The number of Kansas cooperatives with a policy for dealing with equity redemption has increased markedly since the issue was first studied thirty years ago. Cooperatives with the most systematic equity redemption programs are also in the strongest financial position, which supports the idea that sound financial management is critical regardless of equity redemption policy. With an eye toward the future, some Kansas cooperatives are strong enough to make their equity redemption policies more systematic, but others are not. As many previous authors have pointed out, one key to the development of successful equity redemption programs by local cooperatives is to maintain a balance in the equitable treatment of past, present, and future members of the cooperative. Such a balance is a key consideration regardless of the type of equity retirement program adopted.

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Influence of the Farm Credit System Stock Requirement on Actual Interest Rates

Eddy L. LaDue

Abstract

Variability exists in the specific stock requirement plans of Federal Land Bank and Production Credit Associations. The stock requirement increases the annual equivalent rate by one-half to two percentage points depending on the level of the stock requirement, the interest rate, whether automatic or end-of-period cancellation is used, and other factors. Farm Credit System rates should be adjusted for the stock requirement when being compared to other rates at both the farm and national levels. National average Federal Land Bank rates, after adjustment for the stock requirement, have remained below commercial bank long-term real estate rates for the past several years.

Key words: Farm Credit System, agricultural finance, credit, stock, interest rates, cooperatives, equity capital.

The Farm Credit System is an interconnected set of cooperative organizations owned by their borrowers. Ownership is effected by requiring each borrower to purchase stock in the cooperative in amounts proportional to the amount of funds borrowed. The stock provides a major portion of the equity capital required to finance production credit associations (PCAs) and federal land bank associations (FLBAs) as well as district federal intermediate credit banks (FICBs) and federal land banks (FLBs).[1] This equity capital provides the capital base that enables the Farm Credit System to sell its securities to investors.

To finance the stock purchase, the Farm Credit System lends the farmer more money. Thus a farmer must borrow enough money to cover both the needs of the business and the required stock purchases. The stock purchase is typically handled automatically. The borrower may be unaware of the stock purchase.

The stock purchase represents an added cost of the loan and therefore influences the effective cost of the credit to the farmer. Since the interest rates quoted to farmers by the Farm Credit System normally do not include the cost of this stock requirement, they understate the actual interest rate and can lead farmers to make inaccurate comparisons in assessing alternative credit sources. It also results in publication of noncomparable interest rate series at the

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[1] The thirteen banks for cooperatives also have a stock requirement that serves the same function. This article, however, relates solely to farm-level lending.

ational level. Since these interest rate eries are used to indicate relative farm-level iterest costs and industry competitiveness ı agricultural credit policy decision making, this understatement could lead to inacurate policy recommendations.

his article explains the basic stock requireıent plans used by the Farm Credit System nd then discusses the particular charactertics of plans used by individual associaons. The effects of the stock requirement n annual equivalent interest rates are then resented. Finally, farm and national level ses of annual equivalent rates adjusted for ock costs are discussed.

tock Plan Characteristics

tock plans have two basic characteristics ıat determine the effect of the stock equirement on the interest rate that is effecvely paid on loans. Those characteristics re (1) the stock requirement percentage, nd (2) the stock cancellation plan.

tock Requirement Percentage

he stock requirement percentage indicates ıe amount of stock that a farmer must buy s a percentage of the total amount of ıoney borrowed. For example, if the stock equirement percentage was 10 percent and farmer needed $90,000 for his business, e would be required to borrow $100,000 nd buy $10,000 worth of stock.[2]

he stock requirement percentage is curently applied to the gross loan (loan proeeds plus stock) in all cases. Historically, ome associations applied the percentage to ıe amount of the loan proceeds in order to void requiring stock on that portion of the oan used to purchase stock (referred to as harging "stock on stock"). The Farm Credit dministration now requires that the perentage be applied to the gross amount of he loan.

Stock Cancellation Plans

Most PCAs and FLBs use one of two stock cancellation plans: either the automatic or the end-of-period plan. Under the automatic cancellation plan the farmer pays interest on both stock and loan but never makes principal payments on the stock. As the principal on the loan is paid off, the associated stock is automatically reduced (canceled) to the minimum amount required, and the loan on the stock is reduced correspondingly. With this plan there are effectively two loans, one for the farm investment (proceeds of the loan) on which normal interest and principal payments are made and one for the stock on which only interest is paid. The stock loan is always maintained at the stock requirement percentage of the principal outstanding.

Returning to the example, the farmer would make principal and interest payments on $90,000 but would pay only interest on $10,000. As principal payments were made on the $90,000, stock would be canceled and the $10,000 loan reduced so that the outstanding stock (and stock loan) exactly equaled 10 percent of the total balance on the two loans. That is, when the principal was reduced to $45,000 the stock outstanding and the stock loan would have been reduced to $5,000. The $5,000 is 10 percent of the $50,000 balance on the two loans ($45,000 + $5,000).

The end-of-period cancellation plan requires purchase of the same amount of stock at the time the loan is obtained (with a given requirement percentage) as does the automatic cancellation plan, but the loan on that stock remains a part of, and is handled in the same way as, the loan obtained for farm investment. The principal and interest payments are made on both the investment loan and the stock loan. At the time that loan is paid off, the investment in the stock is refunded, or, more frequently, is used to make the final payment on the loan.

For the example situation, $10,000 worth of stock would be purchased, the complete $100,000 would be amortized over the loan period, and the farmer would make principal payments of $10,000 on the stock over the period of the loan. At the end of the loan period the $10,000 stock investment would be refunded. At the farmer's option, pay-

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Theoretically, the farmer could buy the stock with quity funds and borrow only the added funds needed. ut use of equity funds to buy stock would increase the mount of added funds to be borrowed by the amount f equity capital used to buy stock. Thus the amount orrowed and the amount of funds available to the usiness as a result of that borrowing are the same egardless of whether equity capital or borrowed funds re used to buy stock.

ments on the loan could be stopped as soon as the loan had been paid down to the point that the stock to be refunded would be sufficient to make the remaining payment.

Stock Plans Employed by the Farm Credit System

The Farm Credit System is made up of a large number of cooperative associations, each with considerable independence. Therefore, it is not surprising that the specific characteristics of the plans in use throughout the United States vary considerably.[3]

Federal Land Banks

Since federal land bank loans are by law made at the district level with the local FLBAs serving as agent for the district bank, there is one FLB stock plan for each district. The same basic plan is used in many districts. The most widely used plan, which is used in nine of the twelve districts (all except Baltimore, Sacramento, and Omaha), has a stock requirement of 5 percent with end-of-period cancellation. There is no automatic retirement of stock. A borrower can make a special request to retire excess stock, but this is usually granted only in hardship situations. Stock is used to make the final loan payment.

The Baltimore district has a requirement of 5 percent with automatic annual cancellation down to 6 percent. Farmers make principal and interest payments on the complete loan, including the stock. Once each year the excess stock on all loans is retired to the 6 percent level.

The Sacramento district has a requirement of 6 percent with annual automatic cancellation of stock. The borrower pays principal and interest on the entire loan, including the stock. Excess stock is canceled annually and is used to reduce the principal outstanding on the loan. The level of monthly or annual payments is not influenced by the retirement of stock.

The Omaha district has a 5 percent stock requirement with annual automatic cancellation down to 8 percent. Stock cancellation is used to reduce the principal outstanding but does not affect the amount of each payment made by the farmer. Thus the loan is repaid in fewer years than the originally agreed term. This district plans to reduce the 8 percent maximum stock level to 6 percent in the next few years.

Production Credit Associations

The stock requirement percentage on PCA loans ranges from 5 to 10 percent. The 198 associations for which data were obtained varied considerably in the requirement percentages used (table 1).[4]

Table 1. Distribution of Stock Requirement Percentages 198 Production Credit Associations[a]

Stock Requirement Percentage[b]	Associations	
	Number	Percent[c]
5	56	28
7	10	5
7.41	1	1
7.50	8	4
8	23	12
9	1	1
9.09	5	3
10	94	47

[a] From FICBs in Baltimore, Columbia, Louisville, Sacramento, Springfield, St. Louis, and Wichita.

[b] Percent of gross loan.

[c] Totals do not add because of rounding.

Approximately 40 percent of the associations used end-of-period cancellation; 31 percent used automatic cancellation, normally at the time each loan payment is made. In some cases cancellation occurs quarterly. Regardless of the timing, many associations impose a minimum retirement amount, ranging from $2 to $500. Although retirement occurs automatically, it occurs only when the excess stock exceeds the minimum stated amount. Imposition of such a minimum is apparently designed to reduce the accounting burden and generally would have only a minimal effect on the annual equivalent interest rate.

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[3] The information for this section was obtained via mail questionnaire to all FLB and FICB treasurers in the fall of 1981 and personal correspondence with district and association personnel.

[4] This section is based on data supplied by federal intermediate credit banks in Baltimore, Columbia, Louisville, Sacramento, Springfield, St. Louis, and Wichita.

Another 20 percent use one of a variety of modified automatic cancellation plans. A ew have automatic cancellation down to a percentage that is higher (say, 10 percent) han the original stock requirement percentage (say, 5 percent). More frequently, stock s automatically retired whenever total payments on a loan since the last cancellation exceed a prespecified amount, such as $5,000. This method can reduce the bookwork involved when automatic cancellation s not computerized. Other associations will cancel excess stock upon the farmer's equest. For many farmers this is much like end-of-period cancellation because they seldom request cancellation.

n some associations the stock on annual production loans is never retired but is held o meet the stock requirement on future advances on a line of credit or for production loans required in the following year. This practice reduces the new amount that he farmer must borrow whenever credit is needed and allows the loan proceeds to equal the amount of money borrowed on many loans, but the farmer may own far more stock than is necessary for significant portions of the year.

Annual Equivalent Interest Rates

The influence of the stock requirement on the actual interest rate a farmer pays is different for the two stock cancellation plans. With automatic cancellation the annual equivalent interest rate can be calculated very simply by dividing the stated or contractual interest rate (CR) by the number that results when the stock requirement percentage expressed in decimal form (SR) is subtracted from one. For example, if the stated contract rate is 14 percent and the stock requirement is 10 percent, the annual equivalent interest rate (AER)[5] is:

$$(1)\quad \frac{CR}{1 - SR} = \frac{14}{1 - .10} = \frac{14}{.9} = 15.56 \text{ percent}$$

In this case the stock requirement increases the annual equivalent interest rate paid by 1.56 percentage points. Over the range of likely interest rates and stock requirement percentage combinations the stock increases the annual equivalent interest rate by one-half to almost two percentage points (table 2). The absolute effect of the stock requirement is greater at high than at low interest rates.

Table 2. Farm Credit System Annual Equivalent Interest Rates Automatic Cancellation of Stock

Contractual Interest Rate (%)	Stock Requirement (%) 5	8	10
	Annual Equivalent Interest Rate		
8	8.42	8.70	8.89
9	9.47	9.78	10.00
10	10.53	10.87	11.11
11	11.58	11.96	12.22
12	12.63	13.04	13.33
13	13.68	14.13	14.44
14	14.74	15.22	15.56
15	15.79	16.30	16.67
16	16.84	17.39	17.78
17	17.90	18.48	18.89

The influence of the end-of-period cancellation plan on annual equivalent interest rates is much more difficult to determine. The farm cost of stock ownership in this case takes two forms. First, as with the automatic cancellation plan, interest is paid on the stock loan. This is a cost because it represents payment of interest on funds that were not received and were not usable. Second, as principal is paid on the stock investment the farm business is investing its own funds in the stock. It receives no return on this investment, but if the funds could be productively invested in the business they would be earning a return. At a minimum the funds could be used to pay off the debt and the interest cost could be avoided. For a given stock requirement percentage, the end-of-period cancellation plan costs more than the automatic cancellation plan because the amount of stock is not reduced as the loan is repaid. For the example situation, the entire $10,000 would be invested in stock for the life of the loan.

Calculation of the AER for the end-of-period cancellation plan requires use of an iterative mathematical procedure that can be done

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[5] Annual equivalent interest rate is used to represent the actual annual interest rate paid. It is equal to the true rate multiplied by the number of payments made per year and is equal to the nominal rate as used in many textbooks (Lee et al.). The term nominal is not used here, however, in order to avoid confusion because historically nominal has been widely misused.

**Table 3. Farm Credit System Annual Equivalent Interest Rates
End-of-Period Cancellation of Stock
5 Percent Stock Requirement, Annual Payments**

Contractual Interest Rate (%)	Repayment Period (years)							
	1	3	5	7	15	20	25	30
	Annual Equivalent Interest Rate (%)							
8	8.42	8.62	8.65	8.66	8.60	8.56	8.53	8.50
9	9.47	9.69	9.73	9.73	9.65	9.61	9.58	9.55
10	10.53	10.76	10.80	10.79	10.71	10.66	10.62	10.59
11	11.58	11.83	11.87	11.86	11.76	11.71	11.67	11.64
12	12.63	12.90	12.94	12.92	12.81	12.75	12.71	12.69
13	13.68	13.97	14.00	13.99	13.86	13.80	13.76	13.73
14	14.74	15.04	15.07	15.05	14.91	14.85	14.81	14.78
15	15.79	16.11	16.14	16.11	15.96	15.89	15.85	15.83
16	18.84	17.17	17.20	17.17	17.00	16.94	16.90	16.87
17	17.90	18.56	18.26	18.23	18.05	17.99	17.94	17.92

on a computer. Estimates using standard equations or tables are at best rough approximations and are frequently inaccurate.[6] Annual equivalent interest rates were calculated with such a computer routine (LaDue). The routine iteratively searches for the rate of discount that will make the discounted value of all payments equal to the original principal balance. Annual equivalent rates generated for the most frequently used stock requirement percentages, typical repayment periods, and several interest rates are shown in tables 3 through 6. These rates are calculated under the assumption that the FLB or PCA is charging interest on the unpaid balance and that the total of principal plus interest paid each year or month is constant throughout the life of the loan (level payment plans). The calculations are not accurate for loans in which each principal payment is constant and the interest payment declines as the loan is repaid (declining payment plans).

As the term of an annual payment loan is increased from one year, the effect of the stock on the AER first increases and then decreases. This pattern is a direct consequence of the average level of outstanding principal, which results from use of a level repayment plan. The average level of outstanding principal over the life of the loan rises as the term increases to five or seven years and falls as the term increases beyond that point. With a constant stock requirement, the ratio stock to average outstanding principal, and thus the effect of the stock on the AER, varies inversely with the average outstanding balance. The same pattern is exhibited by monthly payment loans with a 10 percent stock requirement except that the average balance starts to decline sooner. At the higher interest rates with a 5 percent stock requirement, the effect of the stock declines consistently as the term is increased over the range presented.

The AERs reported here do not include cooperative dividends. In some cases, PCAs and FLBs may pay dividends (Farm Credit Administration). To the extent that cash dividends are received, the data in tables 2 through 7 will overestimate the cost of the stock to the borrower. If dividends are declared but not paid in cash, the borrower has received an ownership interest in the cooperative for which payment will likely be received at some future date. Unless payment is received fairly soon after the dividends are declared, the impact on the AER will be modest.

For annual production loans with only one payment the automatic cancellation and end-of-period cancellation are effectively the same. Because there is only one payment, no principal payments are made on the stock; it is retired when the final, and only, payment is made. For these situations, equation (1) and table 2 can be used to determine the annual equivalent interest rate.

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[6] The reader can verify this point by estimating AERs using equations and tables found in Board of Governors of the Federal Reserve System or Lee et al.

able 4. Farm Credit System Annual Equivalent Interest Rates
End-of-Period Cancellation of Stock
5 Percent Stock Requirement, Monthly Payments

Contractual Interest Rate (%)	Repayment Period (years)							
	1	3	5	7	15	20	25	30
	Annual Equivalent Interest Rate (%)							
8	8.79	8.80	8.77	8.73	8.62	8.56	8.53	8.51
9	9.89	9.88	9.84	9.80	9.67	9.62	9.57	9.55
10	10.98	10.98	10.93	10.87	10.73	10.66	10.63	10.60
11	12.08	12.06	11.99	11.93	11.78	11.71	11.67	11.63
12	13.17	13.13	13.06	13.00	12.82	12.75	12.71	12.69
13	14.26	14.22	14.14	14.06	13.87	13.81	13.76	13.73
14	15.36	15.31	15.22	15.13	14.92	14.85	14.80	14.78
15	16.45	16.40	16.28	16.20	15.97	15.89	15.85	15.81
16	17.54	17.47	17.35	17.25	17.01	16.93	16.87	16.87
17	18.63	18.54	18.41	18.32	18.05	17.98	17.94	17.92

able 5. Farm Credit System Annual Equivalent Interest Rates
End-of-Period Cancellation of Stock
10 Percent Stock Requirement, Annual Payments

Contractual Interest Rate (%)	Repayment Period (years)							
	1	3	5	7	15	20	25	30
	Annual Equivalent Interest Rate (%)							
8	8.89	9.33	9.42	9.42	9.28	9.19	9.12	9.06
9	10.00	10.48	10.57	10.57	10.40	10.30	10.22	10.16
10	11.11	11.64	11.73	11.71	11.51	11.40	11.32	11.26
11	12.22	12.79	12.87	12.85	12.62	12.50	12.41	12.35
12	13.33	13.94	14.02	13.99	13.72	13.60	13.51	13.45
13	14.44	15.09	15.16	15.12	14.82	14.69	14.60	14.54
14	15.56	16.23	16.31	16.25	15.93	15.79	15.70	15.64
15	16.67	17.38	17.44	17.38	17.03	16.88	16.80	16.74
16	17.78	18.52	18.58	18.50	18.13	17.98	17.89	17.84
17	18.89	19.66	19.71	19.62	19.22	19.08	18.99	18.94

able 6. Farm Credit System Annual Equivalent Interest Rates
End-of-Period Cancellation of Stock
10 Percent Stock Requirement, Monthly Payments

Contractual Interest Rate (%)	Repayment Period (years)							
	1	3	5	7	15	20	25	30
	Annual Equivalent Interest Rate (%)							
8	9.61	9.76	9.67	9.59	9.33	9.20	9.13	9.07
9	10.81	10.94	10.84	10.74	10.43	10.31	10.22	10.16
10	12.00	12.14	12.01	11.88	11.55	11.41	11.32	11.26
11	13.19	13.32	13.16	13.02	12.65	12.50	12.41	12.34
12	14.38	14.49	14.32	14.16	13.74	13.60	13.50	13.44
13	15.57	15.67	15.47	15.30	14.84	14.70	14.60	14.53
14	16.76	16.86	16.63	16.43	15.94	15.79	15.69	15.63
15	17.95	18.04	17.77	17.56	17.04	16.88	16.79	16.72
16	19.14	19.21	18.92	18.68	18.13	17.97	17.88	17.83
17	20.32	20.36	20.05	19.81	19.22	19.07	18.98	18.94

Table 7. Annual Equivalent Interest Rate on Production Loans When Stock Is Not Retired[a]

Contractual Interest Rate (%)	Duration of Loan (months)[b]		
	6	8	10
	Annual Equivalent Interest Rate (%)		
	10% Stock Requirement		
8	9.89	9.36	9.07
10	12.33	11.69	11.34
12	14.76	14.02	13.60
14	17.19	16.34	15.86
16	19.60	18.65	18.12
18	22.00	20.96	20.38
20	24.40	23.27	22.63
	5% Stock Requirement		
8	8.85	8.63	8.50
10	11.05	10.78	10.63
12	13.25	12.93	12.75
14	15.44	15.08	14.87
16	17.63	17.23	16.99
18	19.82	19.37	19.12
20	22.00	21.52	21.24

[a] Stock held for complete 12-month period. Annual rather than monthly compounding and discounting was used.

[b] Number of months during the year for which funds were borrowed. Complete loan amount outstanding for the duration of the loan with one payment of principal and interest at the end of the loan period.

When production loans are repaid in less than one year but the stock is held by the association and used to meet the stock requirement for the following year's loan, the annual equivalent interest rate is higher than that obtained using equation (1). The farmer does not have use of the funds invested in the stock for the whole year. The longer the period between repayment of one year's loan and procurement of the next year's loan, the greater the effect of the stock requirement on the annual equivalent interest rate (table 7).

Farm Level Use of Annual Equivalent Rates

The annual equivalent interest rates, shown in tables 2 through 7, should be compared with rates offered by other sources of funds that require no stock purchase. If there are other credit charges or mandated fees, such as appraisal fees, points, compensating balances, loan application fees, or required insurance connected with either loan, additional adjustments will have to be made to reflect these costs. If there are no such additional charges with either loan, the annual equivalent rate (AER) is comparable to the annual percentage rate (APR) that some lenders may provide when the APR is calculated using the discounted cash flow or equivalent method. The AER for loans from associations that use a modified automatic stock cancellation plan will be between the end-of-period rate and the automatic cancellation rate. Estimation of the exact point on that interval that the AER falls will be based on the characteristics of the plan. The closer it is to an automatic cancellation plan, the closer the actual rate is to the automatic cancellation rate.

Interest rate is only one of the factors people consider in deciding where to borrow funds. Some of the other factors, such as the amount of business and financial assistance received or the desire to support a cooperative that ensures the existence of a competitive source of farm loans, cannot be financially quantified. When nonquantifiable factors are involved, use of annual equivalent rates that incorporate the cost of the stock requirement assists in the analysis by quantifying one variable that was formerly unquantified, namely, the cost of stock requirement.

Farm Credit interest rates are frequently used as a basis for setting rates on personal loan transactions in the agricultural community. They relate primarily to agricultural operations, are easily identifiable, their volume is large enough to result in a stable rate, and the data are readily accessible. Examples include seller financing of the purchase of farm land and family loans made as part of partnership arrangements. Frequently it is the intent of these arrangements that the borrower shall pay the same rate as would be paid to the local FLB or PCA. In such situations the intent would be achieved only if the interest rate charged is the annual equivalent interest rate as shown in tables 2 through 6. If, as frequently happens, the rate used is the PCA or FLB contract rate, the borrower is getting the funds for a lower rate than would be paid to the FLB or PCA.

Assume, for example, that a former owner takes back a 20-year mortgage on a farm nd agrees to interest at the current rate harged by the local FLB. If he asks the ocal FLB for its current rate, he will be iven the contractual rate. Assume that this ate is 12 percent. If the buyer pays 12 perent interest on the loan, he will be paying ess than the annual equivalent rate of 12.75 ercent that would be paid to the FLB for ne same loan (assuming the FLB has a 5 ercent stock requirement and an end-of-eriod cancellation stock plan, table 3). Or, rom a different view, the former owner is eceiving .75 percent lower interest than vould be charged by the local FLB or PCA.

Iational Level Use of Annual Equivalent Rates

he interest rates reported by the system self (Nevin and Guebert), the U.S. Departnent of Agriculture (U.S. Department of griculture), and other official publications Melichar and Balides) are contract rates nd thus exclude the cost of required stock. f course, the interest rates reported for ommercial banks, insurance companies, nd other lenders also exclude all loan fees. n addition, all of these lenders, including he Farm Credit System, may charge points nd other fees in certain geographical locaions, at selected times, and within some conomic environments. The Farm Credit ystem stock requirement is unique in at east two ways, however: (1) it is applied to ll loans made by the system, and (2) the arm Credit System is the only major agriultural lender to impose the requirement. ecause of the stock requirement, reported ates on Farm Credit System loans are iased downward relative to other rates. To ompare its rates directly with other eported rates, as is frequently done (U.S. epartment of Agriculture), can be nisleading.

alculating annual equivalent interest rates orresponding to the reported regional or ational contract rates presents some probems. Considerable complexity is introduced by the wide variability in stock plans sed by the various associations and the ggregation difficulties that variation mplies. Calculating average rates for only a single association or a district composed of associations with relatively uniform requirements can even present obstacles.

The major problems occur in associations with end-of-period cancellation. First, the loan term influences the annual equivalent rate. The average outstanding loan term is available for FLB loans (Nevin and Guebert) but is not published on a regular basis for PCAs. Use of the average could introduce some bias if the distribution of terms around the mean was not uniform, but this effect would likely be minor.

Second, the effect of the stock is influenced by loan refinancing. If a loan is frequently refinanced, and the stock amount is realigned to the outstanding principal each time, the average amount of stock outstanding relative to the average principal outstanding will be lower because the amount of stock relative to the remaining principal balance is lowest at the time the loan is obtained. Refinancing returns the stock to that low level and delays the increase in stock relative to principal that occurs as the loan is paid off. This problem could be handled either by indicating that the calculated annual equivalent rate assumes all loans were held to maturity or by incorporating the average actual outstanding term of loans into the calculation procedure (which would require data not currently published).

Another problem for end-of-period cancellation of short- and intermediate-term loans is that the annual equivalent rates with monthly and annual payments differ significantly. This is primarily a problem with PCA rates because the difference is small for long-term rates (see tables 2 through 6).

Three problems exist in calculating rates for associations with automatic cancellation. All result from employing slight modifications of the automatic cancellation process. First, some associations only cancel stock that exceeds a minimum balance amount, which can result in slightly higher than necessary levels of stock at some times. As long as the minimum cancellation amount is modest relative to the loan, however, this procedure should have little impact on annual equivalent rates. Since most minimums are below $100, there should be little effect on rates.

Second, cancellation is sometimes conducted less frequently than payments are made. For example, all FLBs with automatic cancellation currently cancel annually even though some loans are amortized on a monthly basis, which results in a higher than required level of stock before each cancellation date. This effect on annual equivalent rates would also be small for most loans, particularly long-term loans.

The third problem occurs when the stock is canceled down to a level different from the original percentage purchased. For example, one FLB has a 5 percent stock requirement but automatically cancels down to 6 percent. This procedure represents a combination of automatic and end-of-period cancellation; exact calculation of the annual equivalent rate requires numerous hand calculations or development of a computer routine to determine the amount and timing of stock cancellation.

To develop interest rate series for the Farm Credit System that are comparable to rates reported by other lenders, two alternatives exist. One is to apply an average stock requirement to the average reported contract rate and use the result as an approximation of the annual equivalent rate. Since nine of the twelve FLBs use the same stock plan and the other three employ only slight modifications of that standard plan, use of this alternative should be accurate.

Because of the wide variety of stock plans employed, use of this alternative for PCAs could be more difficult and somewhat less accurate. Use of the average term to estimate an approximate annual equivalent rate would allow for more accurate interest rate comparison than is currently typically done.

The second alternative is for the Farm Credit Administration (FCA) or the USDA, with cooperation from the FCA, to develop a computer routine that incorporates the characteristics of the various stock plans in use and calculates the annual equivalent rates from the reported contract rates and other loan characteristics. This procedure would be most accurate and most efficient in national resource use.

To illustrate application of the first alternative, the rates reported for the federal land banks (Farm Credit Administration) were used to calculate annual equivalent rates covering the period 1977 through the second quarter of 1983 (table 8). These calculations were made using (1) a 5 percent stock requirement with end-of-period cancellation, (2) a 27-year loan term (the weighted average term for new FLB loans made over the period) (Nevin and Guebert), (3) annual payments, and (4) loans held to maturity. Since the data reported in the *Agricultural Finance Databook* are unweighted means of the rates reported by individual districts, a

Table 8. Contract and Annual Equivalent FLB Interest Rates and Commercial Bank Long-Term Real Estate Rates, 1977–1983

Date		Federal Land Banks		
		Contract Rate[a]	Annual Equivalent Rate (approx.)[b]	Commercial Bank[c]
			percent	
1977	Q1	8.5	9.0	9.2
	Q2	8.4	8.9	9.2
	Q3	8.3	8.8	9.2
	Q4	8.3	8.8	9.2
1978	Q1	8.2	8.7	9.3
	Q2	8.3	8.8	9.3
	Q3	8.3	8.8	9.5
	Q4	8.4	8.9	9.7
1979	Q1	8.7	9.3	10.1
	Q2	9.0	9.6	10.4
	Q3	9.3	9.9	10.7
	Q4	9.3	9.9	11.6
1980	Q1	9.8	10.4	12.6
	Q2	10.6	11.2	15.4
	Q3	10.6	11.2	13.4
	Q4	10.3	10.9	13.5
1981	Q1	10.6	11.2	16.0
	Q2	10.9	11.6	15.7
	Q3	11.4	12.1	17.1
	Q4	11.7	12.4	18.0
1982	Q1	12.1	12.8	16.9
	Q2	12.2	12.9	17.0
	Q3	12.4	13.1	17.0
	Q4	12.4	13.1	15.9
1983	Q1	11.9	12.6	14.6
	Q2	11.8	12.5	N.A.

[a] Unweighted average quoted rates, first day of quarter from E. Melichar and P. Balides, *Agricultural Finance Databook*, Board of Governors of the Federal Reserve System, April 1983, p. 32.

[b] Five percent stock requirement with end-of-period cancellation, 27-year term, and annual payments, calculated from the average contract rate.

[c] Average of rates reported for long-term real estate loans made by commercial banks in the fifth (Richmond), seventh (Chicago), ninth (Minneapolis), tenth (Kansas City), and eleventh (Dallas) Federal Reserve Districts. Source: *Agricultural Finance Databook*, Quarterly Series; Board of Governors of the Federal Reserve System.

lightly more accurate procedure would ave involved using the rate for the individ- al districts and then averaging. These uarterly data were not available, however. iven the narrow range usually found for ates in different districts, using the average ate as reported would likely have only a nodest effect on the average equivalent ate, almost certainly less than that imposed y the level of rounding used.

o determine the error introduced by using ne predominant stock plan term to indicate tock cost, the annual equivalent rate was alculated for the lowest (8.2 percent) and ighest (12.4 percent) interest rates reported ver the period, using the actual stock plans n effect for each district. The national AER vas then calculated by weighting the results y the volume of FLB new loans during the ear in which the interest rate was in effect Nevin and Guebert). The AER calculated in nis manner was within one-one-hundredth f one percentage point of the rate calcu- ated using a 5 percent stock requirement nd end-of-period cancellation for the entire oan portfolio as presented in table 8. Given ne level of rounding used, the AERs pre- ented appear accurately to reflect the effect f the stock over this period. As long as only few districts use a stock plan other than ne standard 5 percent end-of-period cancel- ation and the deviations of those who do nake changes are small, rates calculated sing this approximation procedure are pparently fairly accurate.

he annual equivalent FLB rates were .5 to 7 percentage points above the reported ontract rate. Adjusted FLB rates were oughly comparable to bank rates during art of the 1977–83 period, although the tock requirement represented only a small art of the difference between FLB and bank ates during much of the period. The FLB as been able to offer very competitive rates luring the entire period, particularly from 980 to 1982. Although adjusting the FLB ates for the stock requirement presents a nore accurate representation of the rates harged, it does not result in a shift in the elative position of long-term rates charged y lenders.

ince reported PCA rates have generally een significantly higher than FLB rates dur- ng the last few years and PCA stock require- nents are frequently higher than FLB requirements (Melichar and Balides), the difference between the contract and annual equivalent rate for PCAs likely would be considerably greater than that found for FLBs. Information on the stock requirement plans used in all associations would be required to develop an estimated annual equivalent rate for PCAs that would be sufficiently accurate for publication.

Summary and Conclusions

To provide capitalization for the Farm Credit System each borrower purchases stock in proportion to the amount of money borrowed. Payment for this stock is routinely done by increasing the amount of money borrowed. Interest, and in some cases principal, payments are made on stock. Since the extra money borrowed to buy stock cannot be used in the borrower's business, the interest paid on the stock amounts to an added cost of the funds actually received. This stock requirement increases the annual equivalent interest rate by one-half to two percentage points depending upon the level of the stock requirement, the interest rate, whether automatic or end-of-period cancellation is used, the term of the loan, and other minor factors.

The stock requirement should be accounted for in comparing interest rates at both the farm and the national levels. At the farm level the tables presented can be used to estimate the annual equivalent interest rate from the given contract rate. This rate can then be compared with other rates for borrowing money or used as a standard agricultural rate for seller or intrafamily financing.

At the national level FLB and PCA rates should be adjusted for the stock requirement before comparing them to rates offered by other lenders. The FCA and USDA could facilitate national policy formation and analysis by publishing an adjusted interest rate series that reflects the stock requirement.

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itle. Short and to the point, preferably not ıore than 7–8 words.

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AGRICULTURAL FINANCE REVIEW, Department of Agricultural Economics,
Cornell University Volume 44

PREFACE

Agricultural Finance Review provides a forum for presentation of research and discussion of issues in agricultural finance. Publication is annual, and all articles are contributed by scholars in the field. Articles on assigned topics may occasionally be commissioned from specific authors.

Volume 43 was the first to be published at Cornell University. The previous forty-two volumes were published by the United States Department of Agriculture. *AFR* was begun in 1938 by Norman J. Wall and Fred L. Garlock, whose professional careers shaped much of agricultural finance research for many years. Since that time, professional interest in agricultural finance has continued to grow, involving larger numbers of people and a greater diversity in research topics, methods of analysis, and degree of sophistication. We are pleased to be a part of that continuing effort.

The effectiveness of this publication as a means of promoting agricultural finance research and discussion depends on its support by the profession. We have been pleased by the response to date. Sixteen manuscripts were submitted for volume 44. The nine contained herein were selected for publication. We thank all those who submitted manuscripts.

We wish to express our sincere thanks to those who contributed their valuable time to review submissions for us:

Michael B. Boehlje
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Craig L. Dobbins
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We invite your suggestions for making improvements in *Agricultural Finance Review*. Manuscripts for the 1985 issue should be received by February 1, 1985. Manuscripts will be accepted at any time, however, and those received after February 1 will be considered for the 1986 issue.

John R. Brake, Editor
Eddy L. LaDue, Associate Editor
Loren Tauer, Associate Editor

urrent Financial Stress Among armers in South Georgia

sley N. Musser, Fred C. White, and G. Scott Smith

bstract

severe cost-price squeeze, high interest rates, d the stagnation of land prices have created inancial crisis for many farmers in the ited States. This paper considers the current mifications of this crisis for Georgia farmers. survey of farmers in South Georgia nerated data that reveal an array of current ancial situations, that range from normal els of leverage to a large number of olvent firms. A simulation analysis of a presentative farm for the period of 1974-1981 used to relate expansion strategies to this rrent situation. None of the different ategies analyzed resulted in financial uations outside the bounds of the survey.

The current financial stress among farm firms is reported and discussed continually in the popular press and is receiving attention from agricultural economists. In a recent article on financial conditions among southeastern farmers, Sullivan and Wilson predicted that as many as 3,000 farm firms in this area will not survive. The recent economic conditions that created this stress are well known: lower output prices for most field crops, continued increases in the cost of production due to inflation, stagnation or declines in farm real estate values, and high interest rates. Although these conditions can create financial management problems for all firms, some firms experience more severe financial problems than others. Firm growth research has analyzed the impact of different economic situations and management strategies on financial conditions of farm firms. Most recent studies—unlike earlier research in this area—have at least identified situations and strategies with some probability of failure (Musser and White; Patrick; Mapp, et al.; Richardson and Condra; Held and Helmers). All of these studies were concerned with projecting future consequences of current actions. An interesting issue is the capacity of this well-established methodology to model the recent financial conditions of farmers, particularly as influenced by expansion.

The objective of this paper is to assess the current financial condition of farmers in South Georgia. The specific purpose is to present some data on the current financial situation of farm firms and to analyze the impact of expansion on current financial conditions for a representative farm firm. Information from a survey of farmers is the source of data on the current financial situation. A simulation model is utilized to analyze the impact of expansion strategies on the current financial condition.

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esley N. Musser is an associate professor, Fred C. White a professor, and G. Scott Smith is a graduate research sistant in the Department of Agricultural Economics, niversity of Georgia. The authors thank John R. Brake, ernard V. Tew, Loren Tauer, and two anonymous viewers for their helpful comments on an earlier draft of is paper.

Current Financial Situation of Farmers in South Georgia

The data on current financial conditions reported in this paper came from a survey of peanut farmers. The main purpose of the survey was to obtain information on pest management practices for peanuts; questions on the financial situation of the farm firm were included along with questions about other management practices. The data were collected in a telephone survey in late spring and early summer of 1982. The survey was administered to a random sample of peanut producers in six Georgia counties. The sample was stratified by county and pest management practices. The list of peanut producers was provided by the Georgia State Office of Agricultural Stabilization and Conservation Service of the U.S. Department of Agriculture (USDA). A total of 240 producers were telephoned with 192 or 80 percent completing most of the survey. Data on financial situations were obtained from 170 farmers.

One question about the financial situation concerned the farmers' current debt-to-asset ratio. This approach was based on the judgment that farmers would be more likely to disclose a ratio than information about absolute levels of debts and assets. The particular question had a series of steps. First, producers were asked to estimate the value of their total assets (they were informed that assets include everything owned, including land, machinery, livestock, cash, stocks and bonds). Then they were asked to estimate their total debts. The producers were not asked to report either of these values to the interviewer. The producers were then given a number of mutually exclusive alternative relationships between the data, such as debts being equal to assets or debts being more than twice as much as assets, and asked to identify the category closest to their own situation. The categories were created to reflect most plausible leverage relationships which could easily be communicated in the survey. These categories corresponded to debt-to-asset ratios of 200 percent, 101 to 199 percent, 100 percent, 50 percent, 33 percent, 25 percent, and 20 percent.

Survey results are summarized in three financial categories in table 1. All those whose responses indicated a debt-to-asset ratio greater than 100 percent could be considered effectively insolvent. The second group, with debt-to-asset ratios between 51 and 100 percent, could be considered experiencing financial stress. The third group with debt-to-asset ratios of 50 percent or less reflect normal financial conditions. Of the respondents completing the survey, 28.8 percent were insolvent, 40 percent were experiencing financial stress and 31.2 percent were in normal conditions. Tenancy and the respective debt-to-asset conditions are also shown in table 1. Operators who own all the land they farm tended to be in normal financial situations (55.6 percent) while operators who rent all of their land tended to be experiencing stress or insolvency (86.7 percent). Peanut allotment leasing situations showed that operators leasing-out peanut allotments were generally

Table 1. Survey Results of Farmers' Financial Conditions, 1982[a]

		Respondents						
					Peanut Allotments			
		Land			Owner			
Debt-to-Asset Ratio	Financial Condition	Owners	Rent-Own	Renters	(Not Rent)	Rent-Out	Rent-In	Total
0-50%	Normal	35 (55.6)[b]	16 (17.4)	2 (13.3)	21 (52.5)	5 (62.5)	27 (22.13)	53 (31.2)
51-99%	Financial Stress	19 (30.2)	43 (46.7)	6 (40.0)	15 (37.5)	1 (12.5)	52 (42.62)	68 (40.0)
100% or greater	Insolvent	9 (14.3)	33 (35.9)	7 (46.7)	4 (10.0)	2 (25.0)	43 (35.25)	49 (28.8)
Total		63 (100.0)	92 (100.0)	15 (100.0)	40 (100.0)	8 (100.0)	122 (100.0)	170[c] (100.0)

[a] A stratified random sample of farmers with peanut production in six counties of South Georgia.

[b] Percent of debt-to-asset ratio by type of respondent.

[c] Twenty-two of the 192 respondents chose not to respond to the debt-to-asset question.

der normal financial conditions (62.5
rcent) while operators leasing-in allotments
re under stress or insolvent (77.87 percent).

ese data indicate that current financial
nditions are quite severe for this group of
orgia farmers. Farm firm bankruptcies occur
der all economic conditions for various
asons (Shepard and Collins). However, usual
stributions of financial conditions do not
clude so high an incidence of financial stress
d insolvency. For example, Lins, Gabriel,
d Sonka reported that 66 farm operations
t of a national sample of 3,637 had a debt-
-asset ratio of greater than 50 percent at the
d of 1975. One would expect the current
uations to be worse than in 1975, but these
ta indicate a severe financial situation for a
rge proportion of farms.

Several reasons could be suggested for an
oward bias in the reported debt-to-asset
tios. In regard to the particular question,
rmers are more likely to be able to rapidly
stimate total debts than total assets—the
urrent value of some assets may be unknown
nd some assets may be overlooked during
apid mental calculations. Furthermore, the
ming of the survey—early summer—would
ave yielded higher debt-to-asset ratios than
ther times of the year because that is when
ebt for operating inputs for crops is probably
t its highest level while the value of growing
rops would not have been realized or
ncluded in the total assets. On the other hand,
eanut producers would have been expected
o be in sounder financial condition than most
Georgia farmers. However, a severe drought in
Georgia in 1980 resulted in a state average
yield of 1,935 pounds per acre—considerably
below the average production of 3,256 pounds
per acre for the previous two years (Georgia
Crop Reporting Service). This low yield created
unusually severe financial stress for peanut
producers because of high input levels on this
enterprise so that the normal advantage of
peanut production may not have existed.

While some upward bias may be present in the responses shown in table 1, aggregate data also suggest severe financial stress among Georgia farmers. In January 1981, the Economic Research Service of the USDA reported an aggregate debt-to-asset ratio of 26.5 percent for Georgia farmers—the highest state ratio (1982a, p. 5). On January 1, 1982, the Farm Credit Administration reported that 50 percent of the institutional nonreal estate debt in Georgia was held by the Farmers Home Administration; this debt of over $995 million was second in absolute amount only to Texas (pp. 16-17).

While the percentages in table 1 must be interpreted with some caution, it is obvious that a large number of the sample farmers were in severe financial condition. However, the large group that is in normal economic conditions is also quite noteworthy. Some set of management strategies allowed this group of producers to maintain a sound financial condition despite the generally unfavorable conditions. The tabulations in table 1 suggest that owning, rather than leasing, land and peanut allotments may be two of the preferred strategies. The simulation analysis that follows looks at the impact of some expansion strategies on these current financial conditions. Expansion under different land tenure situations will be stressed because of the survey results.

The Representative Farm Firm Simulation Model

The simulation model used in this study was adapted from a model used in earlier research (Musser and White; Musser, White, and Chang). Since the details of this model have been reported in publications on this research, the model will only be summarized in this section with attention to the parameters used in this analysis. The simulation process included financial accounting operations that estimated costs of input services and value of production, calculated income and social security taxes and debt service, and presented an annual financial summary. The simulator allowed annual adjustment of input prices, output prices, consumption expenditures, and asset values. Annual enterprise gross revenues are generated by a normal random number generator subject to a variance-covariance matrix of returns. Mean and variance of important financial variables from 20 repetitions were reported for each year in the simulation period. These variables include net income, assets, liabilities, and equity. The annual changes in these variables and the final year financial condition can then be observed and analyzed for a given beginning position.

The simulation analysis was based on a farm situation that was representative of South Georgia. Principal enterprises were tobacco, peanuts, cotton, corn, soybeans, and hogs. Initial assets included 200 acres of farmland, machinery, equipment, and working capital. For this paper, the simulation period was the seven years 1974-1981. Mean prices and yields were initially 1974 levels; prices were adjusted for observed trends over the period (table 2). Random gross incomes for all enterprises were generated to be consistent with the means and observed variance and covariance relationships over the period.

Two basic financial situations were considered in the analysis. Initial assets were assumed to be $164,288 in all situations and beginning debts were assumed to be either 30 percent or 50 percent of assets. Beginning level for nonreal estate debt was $16,470 and real estate debt was $32,816 for the 30 percent debt situation. Interest rates were 11.8 percent and 15.2 percent for real estate and nonreal debt, respectively, and were assumed constant for the simulation period. While trends in interest rates would have been more appropriate, the simulator did not have this capacity. The rates utilized were representative of the whole period. Asset values were adjusted annually to reflect observed trends (table 2). Consumption withdrawals were assumed initially to equal $15,000 with appropriate adjustments for trends during the period (table 2).

Table 2. Annual Price Trends Associated With Historical Inflation, 1974-1982

	Annual Rate of Increase
Peanuts[a]	.0440
Tobacco[a]	.0586
Cotton Lint[a]	.0000
Cotton Seed[a]	.0000
Corn[a]	.0000
Soybeans[a]	.0000
Wheat[a]	.0000
Hogs[a]	.0000
Coastal Bermuda Hay[a]	.0787
Annual Production Expenditures[b]	.0702
Farm Machinery[b]	.1444
Livestock Equipment[b]	.0813
Land Price[c]	.1185
Land Cash Rent[c]	.0596
Consumption Expenditures[b]	.1082

[a] Calculated from detrended prices (U.S. Department of Agriculture, Statistical Reporting Service).

[b] Calculated from index numbers (U.S. Department of Agriculture, Statistical Reporting Service).

[c] Calculated from first and last year prices (U.S. Department of Agriculture, Economic Research Service, 1982b)

With this simulator, several alternative growth strategies were analyzed: (a) continuation of the base farm situation, (b) expansion by purchasing 200 acres in 1974, (c) expansion by renting 200 acres as of 1974, and (d) expansion by purchasing 200 acres in 1974 and 200 additional acres in 1978. The expansion process also took into account incremental nonland resources for the expanded farm. The rental strategy included cash rent for the land and associated peanut and tobacco allotments, which were inflated at the historical rate for cash rents (table 2).

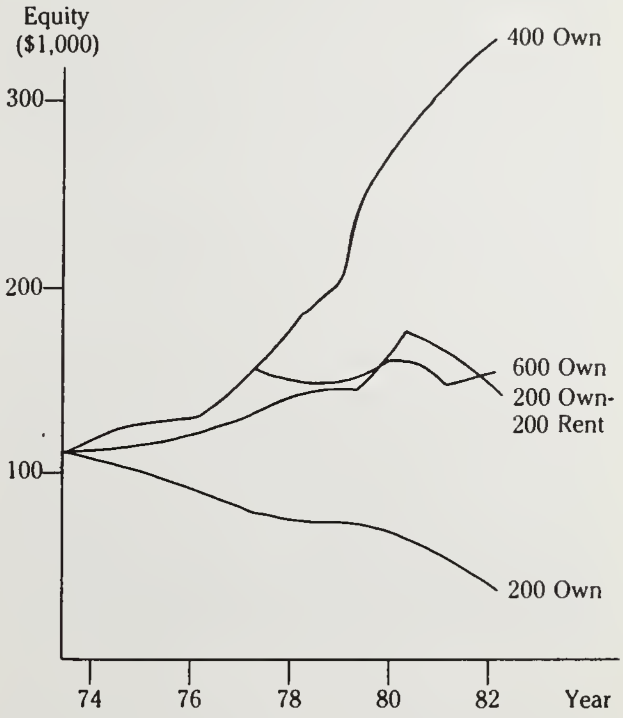
In general, this research utilizes standard simulation methodology for an *ex post* analysis of this historical period. As with past applications of such simulators random outcomes are generated given basic parameters observed during the period, and means and variances of financial results of the random outcomes are calculated. For the purpose of this paper, an alternative would have been to utilize historical values of all the parameters. However, utilization of probabilistic methodology allows an evaluation of the standard methodology. This research provides some evidence on whether current financial situations could have been projected with this methodology, if the correct forecasts of basic parameters had been employed. This issue will be further discussed in the conclusions.

Farm Simulation Results

Final year financial conditions from seven years of simulation for the alternative growth strategies are summarized in table 3. Continuation of the initial farm size of 200 acres resulted in a substantial erosion of equity through time. The final equity level for this case was only one-half of the initial equity level assuming a beginning debt-to-asset ratio of 30 percent. However, the probability that this firm would be insolvent, or have a debt-to-asset ratio greater than or equal to 100 percent, was only 0.017. If this farm had started out with a heavier debt load, the probability of insolvency would have been much greater. Assuming an initial debt-to-asset ratio of 50 percent, the probability that this farm would fail without growth is 0.450. This size farm was apparently not an economical size unit to support a family during this period.

Continuation of operation of the farm at 200 acres is compared with expanding the farm (a) by purchasing 200 acres in 1974, (b) renting 200 acres beginning in 1974, and (c) purchasing 200 acres in 1974 and an additional 200 acres in 1978. Purchasing 200 acres in 1974 was the most desirable alternative. Such expansion was desirable because it allowed achievement of significant economies of size and also because the farm experienced favorable land value appreciation on the purchased land throughout that period. The probability that this farm would be insolvent was zero, even with an initial 50 percent debt-to-asset ratio. Expansion by renting was less desirable because the farm experienced rising costs of production without favorable land value appreciation on purchased land; the slower rate of increase in cash rents than other production expenditures was helpful for this scenario. The probability of the rented farm being insolvent was only .005 under the 50 percent initial debt situation. The farm situation that operated at 400 acres for five years and then at 600 acres for the rest of the period fared better than the no-expansion situation, but outcomes were mixed in comparison to the rental situation. While the larger farm had higher mean equity and no probability of insolvency, it did have a slightly higher probability of the debt-to-asset ratio being greater than 80 percent than did the rental strategy.

Figure 1. Equity Accumulations for Alternative Growth Strategies



The farm situation with 50 percent initial debt, which was analyzed under four alternative expansion strategies, is depected in figure 1. The first strategy—continuation of a 200-acre operation—was the least desirable throughout the entire period. Equity under this strategy showed a steady decline. The three expansion strategies had different results. The 200-acre rental strategy showed growth through 1980 and then rapid decline. The strategy with two

Table 3. Final Year Income and Equity Conditions for Different Firm Sizes

Firm Size (Acres)	Net Income After Taxes ($)		Equity ($)		Debt-to-Asset Ratio	Probability of Debt-to-Asset Ratio	
	Mean	Standard Deviation	Mean	Standard Deviation		≥100%	≥80%
30% Initial Debt							
200 own	−8,093	6,458	57,459	21,667	.831	.017	.318
400 own	35,166	13,954	384,663	43,199	.350	.000	.000
200 own 200 rent	−5,796	13,687	188,998	50,480	.598	.000	.039
600 own	10,489	16,101	192,157	42,041	.689	.000	.063
50% Initial Debt							
200 own	−12,058	6,414	12,810	21,337	.963	.450	.991
400 own	31,160	13,951	339,198	45,935	.415	.000	.000
200 own 200 rent	−10,080	13,739	140,711	48,607	.461	.005	.044
600 own	5,531	16,033	148,222	49,373	.760	.000	.290

200-acre purchases exhibited stagnation after the second expansion. Finally the 200-acre purchase strategy showed steady growth throughout the planning horizon.

It must be stressed that while the simulations reflected conditions over the 1974-1981 period, they generated net incomes randomly from means, variances, and covariances for the entire period. In contrast, the worst years during this period were concentrated in the last few years. Thus, the net income and equity figures in table 3 are probably somewhat optimistic. Nevertheless, the results demonstrate considerable financial stress for many situations. The results are consistent with the overall survey patterns with reference to land tenure. Full ownership strategies were superior to the ownership-rental strategy for the expanded farms. However, the ownership patterns also indicate a possibility of stress particularly for the 200-acre unit and the 600-acre unit.

Conclusions

The recent adverse economic conditions have created severe economic stress for Georgia farmers. Nearly 30 percent of the respondents in a telephone survey reported that they were insolvent. A standard simulation analysis of the historical period for a representative farm suggested several expansion situations which could have created this stress. Surprisingly, the most favorable strategy proved to be the purchase of additional land early in this period, resulting in steady growth in equity and no financial stress even for the higher leveraged situation. In contrast, no expansion was the worst strategy, resulting in a steady decline in equity and a high probability of failure. A two-stage growth strategy to 600 acres resulted in stagnation after the second expansion. Expansion by rental of increased acreage was superior to no expansion but inferior to land purchases.

These results suggest some broader implications. Larger initial owned acreage and/or a lower initial leverage position would probably have resulted in a better current financial situation than the situations simulated. In contrast, a higher initial leverage situation, later land purchases, and/or no initial land ownership would likely result in a worse current equity position. These results correspond with earlier studies that examined low resource and rental situations (Patrick; Richardson and Condra). Farm firms with these financial strategies are likely to be those concentrated in the high stress and insolvent situations. As earlier firm growth literature has stressed, purchase of additional land is desirable especially if it is purchased early in the planning horizon. Later purchases did cause an erosion of equity.

From a management perspective, purchase of land with an unfavorable operating cash flow perspective, as shown in the trends in table 2, is not to be recommended. However, land purchases with immediate profitable operating conditions are desirable because the land value appreciation provides a financial cushion and, as in this study, allows equity to continue growing even in an unfavorable cost-price situation. The other management implication of this analysis concerns expansion to achieve economies of size. The desirability of the expansion strategies over the current situation, as demonstrated in this paper, can be attributed largely to the increase in efficiency in machinery use on the 400-acre farm. Only minimal incremental increases in machinery were necessary for this expansion, so that the greater operating net cash flows did not require much increase in fixed costs of machinery. Part of the problem with two-stage expansion strategy was that few economies of size exist for expansion from 400 acres to 600 acres—additional machinery investment for expansion to 400 acres was $20,310 and for expansion on to 600 acres was an additional $60,015. Thus, these results are consistent with the reasoning of Shepard and Collins concerning economies of size and stress from expansion.

A final methodological implication is that current firm simulation methodology can model situations which produce severe financial stress for a large segment of farms but not for all farm firms. While the survey did provide some data to validate the results, questions on expansion were not included so the simulation analysis could not be completely validated. Such questions would gather information on actual past expansion, planned expansion, and an individual's criteria for evaluating expansion alternatives. As Hanson and Eidman have stressed recently, such validation is necessary before confidence can be placed in the simulation. A broader survey than reported in this paper plus an *ex* *post* simulation similar to the one in this paper is one approach to validate simulation models. However, such an approach will still not validate forecasts of the probability distributions of future outcomes. Since this paper was concerned with simulation of a historical period, no evidence was provided on this crucial input for a simulation model to be used to forecast the future financial consequences of different managerial strategies.

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Credit Scoring for Farm Loan Pricing

Jean Lufburrow, Peter J. Barry, and Bruce L. Dixon

Abstract

A credit scoring technique for pricing loans to individual farm borrowers is evaluated using financial data from five production credit associations (PCA) in Illinois that currently price loans based on credit risk. Statistical analysis using a probit model to account for the qualitative and ranking characteristics of the problem yielded five significant variables — leverage, liquidity, repayment history, collateral, and cash flow. In various tests, the model classified 70 to 80 percent of the PCA borrowers correctly. In general, the results indicate that credit scoring may play a useful role as a tool in loan pricing.

Key words: credit scoring, loan pricing, risk analysis.

The assessment of lending risks for purposes of pricing, supervision, and control has become a timely issue for the Farm Credit System, agricultural banks, and other farm lenders (Bullock; Etherton; Barry and Calvert). The high risks in agriculture, including greater losses for some lenders, growing competition in farm lending, and improvements in the quality and computational processing of financial information are all encouraging agricultural lenders to more precisely evaluate and monitor the credit worthiness of their borrowers. As a result, improved methods of loan pricing should enhance the performance of loan portfolios, lessen the reliance on nonprice factors in credit allocations, and contribute to more efficient, equitable credit services for borrowers.

In this article we estimate and test a credit scoring model that could be used for pricing loans to individual farm borrowers. The analysis utilizes financial data from five production credit associations in Illinois that currently price loans based on differences in borrowers' credit risks. In the following sections we review related literature and develop and test the credit scoring model. Variables believed to influence credit risks are evaluated statistically using a probit model with an ordinally ranked dependent variable that accounts for the qualitative and ranking characteristics of the problem. The validity of the results is considered, along with the general use of credit scoring in loan pricing.

Previous Studies

The use of statistical analysis to determine the relationship between financial variables and credit quality has had much attention in commercial and consumer lending (e.g., Shashua and Goldschmidt; Awh and Waters;

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Orgler). Bankruptcy forecasting is another major area of application (Altman; Collins; Meyer and Pifer). The statistical techniques used in these types of studies have included multiple discriminant analysis, the linear probability model, and logistic regression. Collins and Green evaluated the effectiveness of these methods and concluded that the logit approach has the most appropriate characteristics, although the forecasting accuracy of each method is uniformly good.

Some credit scoring studies have occurred in farm lending as well. Dunn and Frey, Hardy and Weed, Bauer and Jordan, and Johnson and Hagan all used discriminant analysis to classify loans into two categories, usually acceptable and problem loans. An extension of the Johnson and Hagan model has been used in credit examinations of PCAs by the St. Louis Federal Intermediate Credit Bank. While other credit scoring models are likely being used in agricultural lending the extent of such use is not documented, especially in loan pricing. In general, credit evaluations have mostly occurred through the personal observations and subjective judgments of loan officers, using what data farmers have supplied.

Model Development

The basic steps in credit scoring include identifying the variables that best distinguish among credit classes, assigning a proper weight to each variable, scoring each loan as the sum of the variables multiplied by their weights, and assigning the score to the appropriate class based on interclass threshold values. Ranges around the threshold values can be used to identify borderline cases requiring further appraisal by lenders. In principle, the credit score reflects the contribution of each risk factor to a lender's possible loan risk. Thus, the variables affecting credit worthiness provide a logical basis for model specification.

The major variables affecting credit risk, defined as possible loan performance problems, generally include a borrower's liquidity, leverage, profitability, collateral, tenure, repayment capacity, risk strategies, general management ability, along with repayment history and other personal characteristics. Liquidity reflects the firm's present capacity to generate cash to meet its financial obligations. Higher liquidity should signify lower credit risk. Leverage indicates the amount of debt relative to equity capital used by the borrower, with higher leverage adding to a firm's total risk. Profitability indicates the borrower's overall financial progress; it should be inversely related to credit risks, although lenders do not share directly in the borrower's profit position.

Collateral represents the pledge of assets to secure a loan in case of default; generally, more collateral relative to loan size is required on higher risk loans. Tenure reflects the mix of owned and leased assets; greater leasing generally increases risk due to uncertainties of continued asset use and a weaker collateral position. Repayment ability is the borrower's prospects for successfully meeting principal and interest obligations from future cash flows. The remaining variables account for the borrower's personal attributes, general proficiency as a farm operator, and special practices in risk management.

These variables differ in their ease and accuracy of measurement, and in their importance to different types of lenders. Several can be measured in alternative ways. Moreover, personal and management characteristics, while important in credit relationships, are especially difficult to separate from other variables and to measure accurately.

In the analysis below, the variables affecting credit worthiness are represented as follows:

Liquidity (CRL)—current assets divided by current liabilities, where liabilities include the new loan. Alternative liquidity measures are the current ratio and working capital divided by the amount of the new loan.

Leverage (LEV)—the debt to equity ratio.

Profitability (GEO)—the geometric mean of the rate of change in earned net worth in the previous two years. Alternative profitability measures are the ratio of projected earnings before interest and taxes to total assets, and the ratio of earned net worth to total assets.

Collateral (COL)—the ratio of PCA collateral to total PCA line of credit.

Tenure (TEN)—the ratio of acres owned and farmed to total acres farmed.

Repayment ability (CF)—projected net cash flow plus projected grain inventory divided by total line of credit. Alternative repayment measures include various versions of PCA loan margin.

Repayment history (HIS)—the average of loan principal repaid divided by principal due over the past three years serving as a proxy for personal factors and other influences on repayment history.

Statistical Method

An index that expresses the credit worthiness of a population of borrowers could be conceptualized as a continuous function that assigns each borrower an index value indicating his credit worthiness. The interest rate and other loan terms could then be tailored to each borrower's index value. In practice, however, this extent of ranking is not feasible. Most lenders group their borrowers into a few discrete classes for credit evaluation, pricing, monitoring, and so on. Thus, the dependent variable which signifies a borrower's risk class is discrete and ordinally ranked so that Class I, for example, contains borrowers with less credit risk than Class II, which has less risk than Class III, and so on.

The probit model with an ordinally ranked limited dependent variable (OLDV) representing the risk classes is suited for the unique qualitative and ranking characteristics of this problem (McKelvey and Zavoina). Probit analysis is a probability model that predicts the probability with which the observation on the dependent variable associated with a given set of independent variables will fall into a given dependent variable category (Pindyck and Rubinfeld). It utilizes a cumulative normal density function to transform an index number related to the probability of an event occurring into a probability. Given the true underlying model or any estimate of it, observations (i.e., borrowers) can be placed into classes according to the highest probability of occurrence, or by comparing computed dependent variables (credit scores) to threshold values for the categories. Unlike discriminant analysis, the OLDV probit model utilizes the ordinal ranking of the observed dependent variable which implies that more information is being utilized in the estimation process.

The OLDV probit model takes the form:

$$(1)\ y_i = a + b_1 X_{1i} + b_2 X_{2i} + \ldots + b_n X_{ni} + \epsilon_i$$

where y_i is the unobserved value of the dependent variable and ϵ_i is a random error term having a standard normal distribution.[1] W_i is the observed class of the i^{th} observation. An observation is assigned to the various classes based on the following scheme:

W_i = Class I if $y_i > t_2$
W_i = Class II if $t_1 < y_i < t_2$
W_i = Class III if $y_i < t_1$

The threshold structure t_1, t_2 specifies the boundaries of the groups comprising the observable dependent variable. Given that (1) has an intercept term and that the threshold values t_1 and t_2 are usually assumed unknown in empirical work, it is necessary to normalize one of the t_1. This is done here by setting $t_1 = 0$. The b_i coefficients are to be estimated, and the x_{ji} are the credit risk variables. The model is estimated using maximum likelihood (ML) procedures to yield consistent, asymptotically efficient estimates with known asymptotic sampling distributions (McKelvey and Zavoina). In contrast with the interpretation of the b_i coefficients in the classical regression model, the coefficients for this probit model represent the change in the unobserved dependent variable y_i for a unit change in the independent variable. However, for any practical meaning this change must be converted into the change in probability of being in a given class. Furthermore, the change in probability is a function of the level of all the independent variables. Thus, a change in CRL might increase the probability of being in a given class by .1 or .01, depending on the values of the independent variables.

Empirical Application

The credit scoring model was developed using 1982 data for a sample of borrowers from five PCAs in Illinois that classify their borrowers into three risk categories for pricing purposes. Thus the population to which the model applies consists of active borrowers, and does not include nonborrowers or rejected loan applicants. Ideally, the credit score should reflect the relative performance of these borrowers over a number of years. However, limitations on data and research resources compelled us to use the lenders' classifications as the measure for the dependent variable. Three of the PCAs are located in the major grain producing areas of Illinois where corn and soybeans are the principal enterprises. The other two PCAs are located in more diversified areas with dairy, beef, and hog enterprises common. Each of the PCAs priced their loans as: Class I, Prime (lowest risk); Class II, Base (intermediate risk); and Class III, Premium (highest risk). While all five PCAs used the same pricing classification, it is likely that credit quality of loans in each class differed slightly among the PCAs due to differences in credit philosophy of each PCA's management.

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[1] Since y_i is never observed, its scale cannot be estimated. Hence, a normalization must be employed, and it is convenient to assume (1) has been normalized by dividing both sides of (1) by the true standard deviation of the error term, implying that the resulting error term has a variance of one. See McKelvey and Zavoina for more discussion of this identification problem.

Each PCA was asked to select randomly a specified number of credit files from each of the three risk classes, for a total of 60 files at each PCA. This resulted in 241 usable observations: 81 from Class I and 80 each from Classes II and III. The most common reasons for not using observations were the lack of two or three years of data for new borrowers, and the lack of some pro forma data for low risk borrowers. The data in the credit files were organized and compiled in a similar fashion among the five PCAs and thus among their borrowers. The general approach is for the borrower to provide the data which are accepted as valid by the PCAs in their credit analysis. Farm visits by lenders and occasional verification of collateral values are common in the validation process.[2,3]

To estimate and validate the model a testing procedure is used which divides the sample of 241 borrowers into a model-generating sample of 202 and a test sample of 39. The test sample was chosen randomly from the complete sample. The coefficients of the credit scoring model were estimated from the model-generating sample and tested for predictive accuracy using the test sample. Additional tests also occurred on the model-generating sample itself, as well as using coefficients estimated from the total sample.

Model Results

The model that was determined the best in classifying the borrowers by credit risk is

$$\begin{array}{lllll} y = .45 & + \; 1.22\,\mathrm{CRL} & - \; .77\mathrm{LEV} & - \; .82\mathrm{COL} \\ \quad (1.16) & \quad (5.52) & \quad (-4.45) & \quad (-7.24) \\ \quad + \; .43\mathrm{CF} & + \; 1.03\,\mathrm{HIS} & & \\ \quad\quad (2.11) & \quad (2.13) & & \end{array}$$

Five factors are statistically significant at the five percent level (t ratios are in parentheses) in determining credit risk: liquidity, leverage, collateral, repayment ability, and repayment history. Profitability and tenure were insignificant and thus omitted from the model. The signs of the coefficients are as anticipated. The positive signs of CRL, CF, and HIS indicate that an increase in any of their values would increase the credit score, and thus reduce total credit risk. Finally, the correlations between the various risk variables are relatively low.[4]

Two threshold values exist for the model. One threshold must be prespecified; the suggested

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[2] PCAs are generally considered to use uniform methods of loan analysis, credit evaluation, and risk assessment; however, differences may still occur in the completeness of financial data, especially for the most credit-worthy borrowers, and in the relative weights lenders assign the various credit factors. While these differences are considered minor and are difficult to measure, they may still influence the credit scoring analysis.

[3] Observations (116) lacking data for only one or two risk sources were still included in the analyses to assure a sufficient sample size. The measures for liquidity, leverage, collateral, and tenure were complete for every credit file. For profitability, repayment ability, and repayment history, however, median values of these variables for the respective credit classes were assigned to the missing values (the numbers of missing values provided in this manner are: CF, 93; HIS, 52; and GEO, 26). Also, a few observations were exceedingly large relative to the entire range of values for the variable involved. Since these outliers could substantially affect the results, the values of ten observations (five each for liquidity and leverage) were changed to equal the next highest values in the sample. For example, the current ratio for one borrower was reduced from 99,225 to 15. Lenders would likely not respond much differently in their risk assessment of these two values.

[4] Two of the coefficients also appeared sensitive to the sample selection, which was surprising given the relatively large sample. When estimates were based on the 241 observations, rather than the 202 observations in the model-generation, the coefficients for CRL and LEV declined to .85, and −.49, respectively; these changes tended to be counterbalancing. The values of other coefficients changed much less. This might imply a need for additional risk factors (independent variables) not available from the PCA records.

practice is to set t_1 equal to zero (McKelvey and Zavoina). The other threshold, t_2 thus becomes an identified parameter. It appears in the likelihood function and is thus estimated by ML. It equals 1.84. Credit scores (y_i) less than zero indicate high risk, and scores above 1.84 indicate low risk. Credit scores between zero and 1.84 indicate intermediate risk.

The model's predictive accuracy was evaluated by comparing the model's classification of borrowers to the PCA's classification. Two classification methods were used, based on (a) probabilities of being in the respective classes, and (b) comparisons of credit scores and threshold values. For method (a), the OLDV model generates probabilities of the borrower falling in each credit class. The borrower is then classified according to the highest probability. For example, borrower 1 had a 4 percent chance of being in Class III, a 20 percent chance for Class II, and a 76 percent chance for Class I. Since his PCA placed him in Class I, the model is considered to classify him correctly. Using this method, 66 percent of the model generating sample were classified correctly; the greatest accuracy occurred for Class I (94 percent) and Class III, (91 percent) compared to Class II (13 percent).

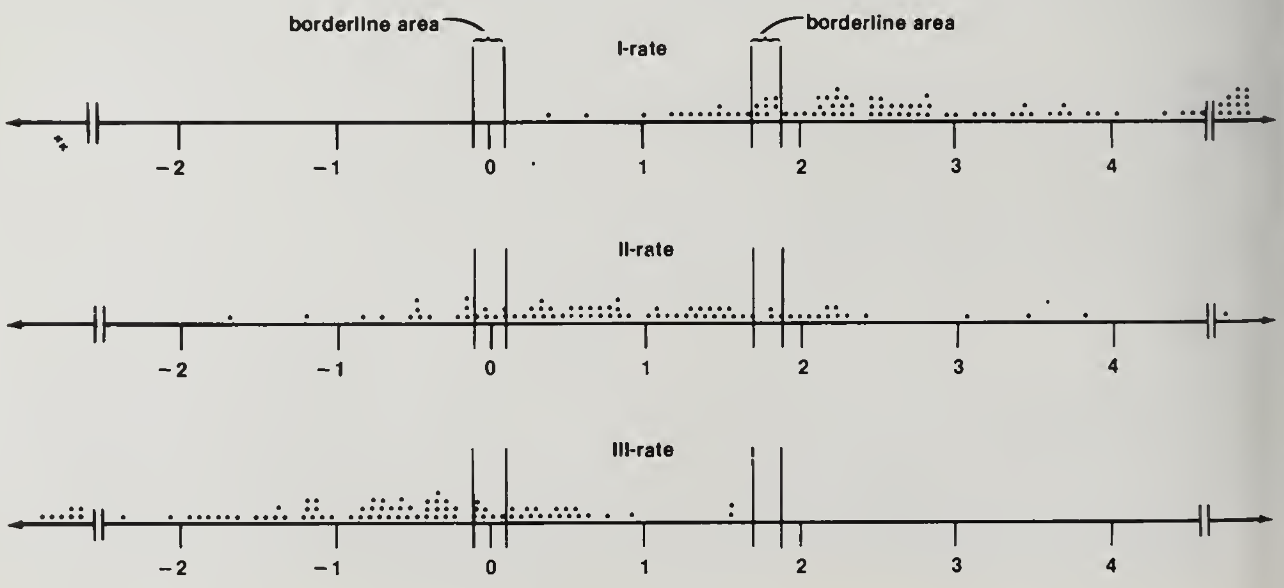
The second method of testing predictive accuracy is to classify borrowers based on comparisons of their credit scores to threshold values. A lender using the model would likely employ this method; thus, it is preferred here. This method correctly classified 79 percent of the test sample: 100 percent of Class I, 62 percent of Class II, and 77 percent of Class III. The lower accuracy for the middle group likely occurs because it is bounded on both sides by the outer groups. When applied to the entire sample of 241, the equation estimated from the 202 observations classified 71 percent of the borrowers correctly. This classification rate increased to 76 percent when borderline cases were considered as correctly classified.

As figure 1 shows, the majority of observations for each class are correctly classified. Some of these classifications fall near the threshold values and are borderline cases. Here, borderline cases are defined arbitrarily as those falling within ±.1 of the threshold value. These observations could either be accepted as classified correctly (truly borderline), or they may be set aside for further evaluation by lenders to determine the appropriate classification.

Implications for Credit Analysis

These credit scoring results suggest that the scoring concept has promise as a tool to aid in risk classifications of borrowers for pricing purposes. Five of the risk variables were significant and had the correct signs using the

Figure 1. Computed Index Values for the Sample of PCA Borrowers



OLDV probit method, which properly accounts for the ranking and discrete characteristics of the risk classes. The rate of correct classifications (66 to 79 percent) is relatively high, especially since this analysis improved upon other credit classification studies by using three rather than two classes of acceptable borrowers. The rates of correct classification for other agricultural studies, based on the total sample and two classes, were as follows: Dunn and Frey, 75 percent; Johnson and Hagan, 62 percent; Hardy and Weed, 81 percent; and Bauer and Jordan, 85 percent.

Other factors also influenced the accuracy of the results. Two of the surveyed lenders observed that several of their own classifications should have been different; however, without these borrowers' requests for upgrading, the revision in classes tended to lag about a year. Second, some borrowers were borderline cases from the PCA's standpoint. Third, as indicated earlier the five PCAs likely differed in their credit policies and economic environment, although these differences were considered minor and were not tested. Fourth, credit evaluation is strongly influenced by subjective, nonquantifiable factors such as integrity, management ability, and spending habits, that are not easily modeled. Fifth, judging the model by its accuracy in reproducing lenders' decisions assumes that the lenders themselves were correct in predicting future loan performance even though errors likely occur. As indicated earlier, a better test of the model would analyze its accuracy in predicting borrowers' actual performance. This might involve comparing the credit score with farm firm performance in future years. For example, one might test to see if the model's risk classifications correspond with the firm's eventual change in net worth, realized cash available for debt servicing, or actual repayment performance.

The scoring method illustrated here is intended to aid in pricing loans. It provides a uniform and objective standard for pricing decisions based on differences in credit risks, while still allowing for further analysis of borderline borrowers. The estimation procedure can be tailored to the characteristics of specific lenders, locations, and types of borrowers. The lender can base the price spread for the respective classes on profitability targets for the total farm loan program, as well as considering the size of the classes, the incidence of loss within each class, competitive factors in the loan market, and experience with borrowers in their acceptance of differential rates. Lenders may also change the level and number of threshold values based on differences in their preferences for credit standards and desired precision in pricing; this would re-introduce some subjectivity into the process, although the measured risk and ranking of each borrower would remain the same. Alternatively, the model could be re-estimated based on different numbers of classes and thus threshold values.

The scoring approach also enables the lender to advise the borrower about the factors that comprise the credit score, and about trade-offs or changes needed in selected variables to warrant reclassification. For example, a borrower whose variables are valued CRL = .5, LEV = 3.00, COL = 2.0, CF = .8, and HIS = .8 would have a credit score of -1.72, placing him in Class III (high risk) for pricing purposes. To reach Class II, with a threshold value of zero, he might reduce leverage to 0.76, while holding other variables constant. Alternatively, he might increase liquidity to CRL = 1.00 and reduce leverage to LEV = 1.56, with other variables held constant. Other trade-offs could be similarly evaluated.

Clearly, credit scoring appears to have considerable usefulness as a tool in loan pricing decisions, as well as in identifying acceptable and unacceptable borrowers at loan application time. Additional study appears warranted to test the usefulness for different farm situations and for different types of lenders. As these studies accumulate, analysts, loan officers, and others will be better able to assess the importance of various risk factors, determine the usefulness of credit scoring models, and design more effective pricing policies.

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The Role of Federal Crop Insurance in Farm Risk Management

Warren F. Lee and Amadje Djogo

Abstract

This article examines the effects of the recently revised Federal Crop Insurance Corporation (FCIC) programs on income variability for a 600-acre, eastern cornbelt grain farm. Risk-returns trade-off frontiers were generated by MOTAD analysis. Results indicate that FCIC's area yield coverage does not reduce income variability; however, the Individual Yield Certification (IYC) option reduces income variability somewhat at the maximum coverage and price options. Farmers' use of FCIC coverage could be increased if higher coverage levels were offered in low-risk farming areas. All-peril crop insurance was also found to be effective in reducing loan losses for agricultural lenders.

Key Words: Federal Crop Insurance Corporation, farm income variability, MOTAD analysis, risk management.

Risk and uncertainty are a fact of life in any business, and farming is generally perceived to be a risky business. The major sources of risk in farming include unstable product prices and yields, unpredictable variations in input costs, technological change, changing government policies, and personal risks affecting the operator and family. This study focuses on product yield risk.

Although the likelihood of severe crop losses due to natural hazards has been substantially reduced by technological advances, year-to-year variations in yields continue to pose a significant risk. Causes of yield risk vary greatly by commodity and by region. A summary of indemnities paid by the Federal Crop Insurance Corporation (FCIC) over the period 1948-1982 on all insured crops in the United States indicates that the four leading causes of reduced yield are: drought (41.9 percent of total indemnities); flood or excess moisture (17.7 percent); frost, freeze, or winter kill (14 percent); and hail (13.2 percent). The remaining 13.2 percent of total indemnities covered losses caused by wind, insects, disease, or other miscellaneous causes.

Moisture (too much or too little) is a major concern for all crop producers. It is widely recognized that the "dust bowl" drought of the 1930s was the most severe in United States history. It affected more than 75 percent of the nation's cropland and it severely affected 27 states. Severe yield losses combined with depressed commodity prices caused financial ruin for thousands of farmers. More recently, drought severely affected crop production in many parts of the nation in 1977, 1980, and 1983. Corn and soybean yields in the eastern cornbelt were reduced significantly in 1981 by excessive rainfall during the critical planting and early growing season.

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Managerial Responses to Yield Risk

The primary response to yield variability caused by natural hazards has been widespread adoption of new technology. Chemical control of weeds and insects is now routinely used and modern genetics has produced varieties that are highly resistant to blights, rust, fungi, and so forth. For the most part, the costs of adopting chemicals and genetic improvements have been modest; however, there is continuing concern about potential adverse effects of chemicals on the environment. Moisture control—irrigation and drainage—are much more expensive and widespread adoption has been slow because of high initial investment and maintenance costs.

Despite technological advances, yield variability is still a major problem for most crop producers; thus, farmers typically adopt other management strategies to deal with yield and other risks. Most farmers, for example, carry several types of reserves. Excess machinery capacity reduces yield losses during unusually wet planting or harvesting seasons. Carry over feed inventories are commonly held by livestock producers as a hedge against short crops. Reserves of liquid assets and unused credit are widely used to minimize the financial consequences of low yields or other adversities. These reserves involve a significant opportunity cost.

Government Programs

Because yield and commodity price risk are so pervasive, the U.S. government has played a significant role in risk reduction since the 1930s. Commodity price support programs, special credit programs, and the all-risk crop insurance program were instituted in the 1930s in response to the widespread financial distress created by yield losses and depressed commodity prices during the Depression. The FCIC all-risk crop insurance program was first enacted in 1938 and originally covered only wheat. It has gradually been expanded and since 1983, FCIC all-risk insurance has been available on 30 different crops under 15,321 county programs.

In response to the long-standing problem of low participation, the FCIC program was substantially changed under the Federal Crop Insurance Program of 1980 (Todd). Ceilings on the number of counties and crops that can be added each year were removed. To facilitate this expansion the capital stock and annual operating expenses appropriations were increased. FCIC was also authorized to contract with private insurance companies and agents in writing coverage and marketing policies and to reinsure crop insurance offered by state and local governments.

The attractiveness of the insurance contract has also been enhanced (Griffin and Black; Willett). Three coverage levels—50, 65 and 75 percent of normal yield—and three price options are available. Producers who believe that their average production is understated by FCIC's area yield estimates can obtain higher coverages under the individual yield certification (IYC) or producer reported yield (PRY) options. To qualify for the IYC option, producers must document yields that have been above the area average for the last three or more years. The IYC option offers added coverage with no increase in premiums above the area average plan. PRY coverage is designed for livestock producers and requires one year of certified production and two years of reported production, approved by ASCS. Premiums for PRY coverage are proportionately higher than area yield premiums.

In addition to offering larger and more individualized policies, the FCIC was authorized to subsidize premiums on the 50 and 65 percent coverage levels. The authorized subsidy ranges from 20 to 40 percent. Producers buying 75 percent coverage receive the subsidy up to the 65 percent level, but must pay the full premium on the remaining 10 percent. Premium reductions are offered to producers with favorable continuous insurance experience, while those with unfavorable experience are subject to premium surcharges. FCIC premiums are calculated to cover only indemnities. Operating and administration costs are borne by taxpayers.

The decision to purchase FCIC all-risk crop insurance must be made prior to the planting season. Coverage is based on insurable units which are based on the farm accounting system. Some producers can qualify for more than one insurable unit, for example, one unit for owned land and additional separate units for rented land. Reports of loss are submitted after harvest. An FCIC adjustor visits the farm, measures any crop stored, inspects records of production sold or stored, and obtains information regarding the size and condition of acreage planted. Indemnities paid are based on the adjustor's findings.

It is apparent from the recent modifications that FCIC's objective is to encourage above average producers to participate. The primary objective of this article is to report the effects of more individualized coverage plans on grain farmers who due to superior management and/or soil types do achieve above average yields. The actuarial feasibility of different coverage levels is examined using a unique but readily available source of crop yield data. Implications for producers, lenders and the FCIC are also examined.

Theory and Methodology

The analysis is based on the assumption that farmers make decisions on the basis of expected utility, where utility is a function of income and risk. In this study, income is defined as return above fixed costs, or gross margin, and risk is represented by the standard deviation of gross margin. In this study, the E-V efficient frontiers were developed using Hazel's MOTAD model. MOTAD generated frontiers represent sets of production plans that are efficient in the sense that total absolute deviations below the mean (A) are minimized for each level of expected income (E). In other words, MOTAD generates an E-A frontier which in most respects has properties similar to those of an E-V function originally developed by Markowitz. The major advantage of the MOTAD model is that it can be solved with conventional linear programming algorithms that have parametric options. E-V frontiers can be generated only by quadratic programming algorithms that are considerably more complex and more error prone (Tauer). Following Hazel's work, the MOTAD model has been used in a number of studies of decision making under risk in agriculture, for example, Schurle and Erven, Persuad and Mapp.

Data Requirements

The MOTAD model requires time series data on gross margins for each of the three crops analyzed: corn, wheat, and soybeans. Gross margin can be defined as

$$g = \sum_i P_i Y_i - \sum_j p_j x_j \qquad (1)$$

where P_i = the price received for crop i

Y_i = the yield per acre for crop i

p_j = price per unit of variable input j

x_j = quantity of variable input j used

Crop yield data (Y_i) were obtained from published results of variety test trials conducted by the Ohio Agricultural Research and Development Center (OARDC) in Wood County, Ohio, from 1972 to 1981. Annual yield observations for each of the three crops were computed as the simple average of four varieties. The varieties selected are widely used by commercial producers and were consistently tested throughout the ten-year period.

Ideally, yield data for a study of this type would be obtained from commercial producers. However, relatively few farmers keep accurate yield records over a ten-year period—the time period generally used by the FCIC to estimate its premium schedules. Hence, the cost of obtaining accurate, historical yield data from farmers was considered prohibitive. County average yields were another readily available source, but as Eisgruber and Schuman and others have pointed out, aggregate yield data series generally understate the variability experienced by individual farmers. Although the variety test yields may overstate estimated mean yields and understate yield variability, they are considered to be a reasonable proxy for the yield experience of the above average producers that FCIC hopes to attract with the new IYC and PRY options.

The Hoytville soil on which the tests were conducted is a dark-colored, poorly-drained clay that formed on high-lime glacial till on nearly-level lake plain topography. The site is tile-drained to correct the major hazard on this otherwise highly productive soil. Conventional tillage practices and recommended application rates of fertilizer, herbicides, and insecticides are followed and to the extent possible, the tests are designed to duplicate commercial production conditions.

Area and county cooperative extension agents confirmed that their "better" producers' average yields are similar to those reported from the variety tests. This assertion is to some extent verified by the yields used to compute the productivity indexes (PI) for Ohio soils. The PI yields represent levels that have been achieved by 50 percent of the producers and are based on a combination of research data, soil interpretation record (SCS form No. 5), county soil survey reports, and field tests. As noted in table 1, the variety test and PI yields are reasonably close for corn and soybeans. The only major discrepancy is for wheat yields.

Local cash prices received at harvest were used to estimate crop prices. These seasonal average price series were adjusted to the 1981 level using the index of prices received for all crops by Ohio farmers. The use of an all-crops price index tends to dampen the harvest-season price variability actually experienced; however, to the extent that farmers adopt various price stabilization measures such as contracting, hedging, spreading sales, and government programs, unadjusted harvest prices would overstate variability. Given these offsetting influences, the indexed series used here is thought to be a realistic proxy for year-to-year price variability.

Gross margins for the three crops were computed annually by multiplying the yield (from the variety test series) by the inflation adjusted prices received and subtracting variable production costs obtained from the 1981 Ohio State University Crop Enterprise budgets for corn, soybeans, and wheat. Since expenses are largely known just prior to the planting season when the insurance decision is made, it was assumed that production costs were fixed; hence changing yields and prices are the only sources of variation in the gross margins. In plans where crop insurance coverage was purchased, gross receipts were increased by the amounts of any indemnities received, and variable costs were increased to reflect premiums paid.

The first phase of the analysis was to model a base farm plan with no crop insurance for a typical, 600-acre crop farm in northwest Ohio. Minimum acreage restrictions were imposed on each of the three crops to represent, as closely

Table 1. Variability in Yields, Prices, and Gross Margins of Corn, Soybeans and Wheat, Northwest Ohio, 1972-1981.

	Corn			Soybeans			Wheat		
Year	(1) Test Yield	(2) Price[a]	(3) Gross Margin[b]	(4) Test Yield	(5) Price[a]	(6) Gross Margin[c]	(7) Test Yield	(8) Price	(9) Gross Margin
	(bu./ac.)	($/bu.)	($/ac.)	(bu./ac.)	($/bu.)	($/ac.)	(bu./ac.)	($/bu.)	($/ac.)
1972	148.3	3.00	271	53.2	7.58	295	80.8	3.21	157
1973	152.5	2.97	279	34.9	7.14	141	46.4	4.83	122
1974	78.9	3.62	112	31.8	8.21	153	76.2	4.32	227
1975	170.3	2.99	336	60.9	6.12	265	68.2	4.17	182
1976	157.3	2.70	251	50.5	7.14	288	45.2	3.74	66
1977	146.4	2.31	164	55.4	6.45	249	62.9	2.47	53
1978	115.1	2.58	123	44.6	7.91	245	61.4	3.79	130
1979	166.9	2.89	309	53.6	7.71	305	73.2	4.79	248
1980	170.3	3.32	392	55.4	8.42	358	75.9	4.26	221
1981	117.7	2.44	113	27.1	6.22	61	51.3	3.53	79
Mean	142.4	2.88	236	46.7	7.36	236	64.1	3.91	148
Std. Dev.	29.7	.40	101	11.6	0.83	91	12.9	0.72	70
Min.	78.9	2.31	112	27.1	6.12	61	45.2	2.47	53
Max.	170.3	3.62	392	60.9	8.42	358	80.8	4.83	248
Coeff. of Var. (%)	20.8	13.9	42.8	24.8	11.3	38.6	20.1	18.4	47.3
Addendum - Comparative yield data									
County Ave. 1972-1981	103.0			31.4			47.6		
FCIC Area Yields	98.7			31.3			44.0		
Productivity Index	135.0			46.0			48.0		

[a] Adjusted to 1981 dollars using index of prices received by Ohio farmers for all crops.

[b] Col. (1) × Col. (2) minus variable cost per acre of $173.70, rounded to nearest whole dollar.

[c] Col. (4) × Col. (5) minus variable cost per acre of $107.98, rounded to nearest whole dollar.

[d] Col. (7) × Col. (8) minus variable cost per acre of $102.58, rounded to nearest whole dollar.

as possible, a realistic farm organization for that area. These minimum acreages, 108 acres for corn, 123 acres for soybeans, and 69 acres for wheat, reflect the actual allocation of total acreage to these three crops in Wood County. In addition to these minimum acreage constraints, the model was further constrained to a 1.14 to 1 soybeans to corn-acres ratio, also based on historic experience in Wood County.

The minimum acreage and soybeans to corn-acreage ratio constraints essentially forced the MOTAD model to generate only diversified cropping plans. Some diversification among these three crops is the norm in northwest Ohio. Farmers diversify to reduce risk and to better utilize labor and machinery throughout the year. The constraints also eliminate the generation of unrealistic solutions that are a common problem in analyses of this type.

Results

Gross Margin Variability

Table 1 contains yields, inflation-adjusted prices, and gross margins for the three crops for the period 1972 to 1981. Based on mean gross margins per acre, corn and soybeans were equally profitable plus they were significantly more profitable than wheat. It should be noted that the sale or home use of wheat straw was not considered. According to the enterprise budgets, sale of the straw would add approximately $40 per acre to the gross margin for wheat. The coefficients of variation for the gross margins indicate that wheat involves the most risk, followed by corn and soybeans. The higher variability of soybean yields is more than offset by the much lower soybean price variability.

Casual observation of the price and yield data reveals much about the risks facing crop producers. Corn growers with yields the same as the variety tests would have experienced very low returns to fixed factors in 1974, 1978, and 1981. In all three years, below-average yields were the major factor, and a virtual disaster was avoided in 1974 only by unusually high corn prices. At the other extreme, gross margins were well above average in 1975, 1979, and 1980 due to a fortunate combination of above-average yields, and in 1975 and 1979, above-average prices. Similar observation can be made for soybeans and wheat. As a risk management strategy, crop diversification can be a success some years and a failure in others. Low returns caused by poor corn and soybean yields in 1974 were partially offset by the above-average yield and price for wheat. In 1981, however, all three crops had below-average yields and prices.

The intuitive conclusions about diversification are confirmed by the correlation matrices for prices, yields, and gross margins in table 2. The r²s indicate that corn, soybean, and wheat prices are all positively correlated over time; however, the r²s for wheat and soybean prices are comparatively low. Corn and soybeans are affected by similar hazards, so it is not surprising to observe that their yields are highly correlated. Soft red winter wheat, with its very different seasonal production pattern, offers potential gain from diversification. Wheat yields are only moderately correlated with soybean yields, and are virtually independent of corn yields. In practical terms, if the corn crop is below average, then there is a 50 percent chance that the wheat crop will be above average. The correlation coefficients for the gross margins confirm that a wheat crop has the potential to mitigate the yield and price risks of a corn-soybeans rotation.

Table 2. Correlation Matrices

Level	Corn Insurance	Soybeans Insurance	Wheat Insurance
A. Prices			
Corn	1.00	0.58	0.60
Soybeans		1.00	0.36
Wheat			1.00
B. Yields			
Corn	1.00	0.75	−0.02
Soybeans		1.00	0.40
Wheat			1.00
C. Gross Margins			
Corn	1.00	0.68	0.43
Soybeans		1.00	0.35
Wheat			1.00

Base Model

Panel A in table 3 contains MOTAD-generated efficient farm plans determined under the acreage constraints described earlier. These acreage constraints restricted the MOTAD solutions to generally diversified farm plans with expected gross margins ranging from $110,000 to a maximum possible $135,321. In

Table 3. Summary of Risk Efficient Farm Plans

		Expected Gross Margins ($1,000)						
Enterprise	**Unit**	**110**	**115**	**120**	**125**	**130**	**135**	**GM[a]**
Corn	acres	113	139	166	193	220	246	248
Soybeans	acres	129	159	189	220	250	281	283
Wheat	acres	358	302	245	187	130	73	69
A. Base model								
Standard Deviation	($000)	41.6	42.3	43.9	45.5	48.7	52.1	52.3
Coefficient of Variation	(%)	37.8	36.8	36.6	36.4	37.4	38.6	38.6
B. 75% IYC, High Price Option[b]								
Standard Deviation	($000)	41.2	40.4	40.5	41.7	44.0	—	46.7
Coefficient of Variation	(%)	37.5	35.2	33.7	33.4	33.9	—	34.6
C. 80% IYC, High Price Option[b]								
Standard Deviation	($000)	40.0	39.5	39.0	39.2	41.1	43.5	44.0
Coefficient of Variation	(%)	36.4	34.4	32.5	31.4	31.6	32.2	32.3

[a] This is the farm plan maximizing gross margin.

[b] Acreages in panels B and C were almost identical to the base firm plan in panel A.

the absence of these constraints, total gross margin would have ranged from a low of $88,800 (600 acres of wheat) to a high of $141,600 from 600 acres of either corn or soybeans, both of which have gross margins of $236 per acre.[1]

The acreage constraints did serve the purpose of restricting the set of feasible plans to those that are more typical in northwest Ohio. They also forced the model to generate farm plans that differ little on the basis of risk relative to income, as indicated by the nearly identical coefficients of variation. However, marginal risk—the increment in standard deviation divided by the corresponding increment in gross margin—increases as one moves up the frontier, from 0.16 over the gross margin range $110,000 to $125,000 to 0.66 over the range $125,000 to $135,321.

Effects of FCIC All-Risk Crop Insurance

Insurance options examined were the 75 percent area yield plan, 75 percent IYC, and two hypothetical higher coverages, 80 and 90 percent IYC. For all coverages it was assumed that the highest available price options were selected. Premiums for the 75 percent yield plans were the ones actually charged by FCIC for the 1982 crop year (see table 4). As is apparent from table 4, the subsidized, 75 percent area yield coverage premiums were not actuarially feasible, given the claims experience of the case farm. Average premiums would have fallen short of average indemnities per acre per year by $2 on corn and $3.08 on soybeans. The premiums on wheat would have been $3.20 per acre above average yearly indemnities. In view of these discrepancies, an attempt was made to calculate actuarially feasible unsubsidized premiums for the 75, 80, and 90 percent IYC coverages using the normal curve approach described by Botts and Boles. Briefly, their procedure estimates the average loss or indemnity for those years in which actual yields are below guaranteed levels, assuming that crop yields are normally distributed.

Area Yield Plan

As the data in table 4 indicate, crop producers with yields equal to the variety performance tests would have collected no indemnities from 1972 to 1981, yet they would have paid cumulative premiums of more than $29,000 over the ten-year period.[2] The reason is that the FCIC's maximum (75 percent) coverage levels are all below the minimum test yields recorded during the ten-year period. Minimum test yields (and the year they occurred) were 78.9 bushels per acre (1974) for corn, 27.1 bushels per acre (1981) for soybeans, and 45.2 bushels per acre (1976) for wheat—all well above FCIC's maximum coverage levels shown in table 1.

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[1] The optimal solution to the unconstrained problem is 600 acres of soybeans because the gross margin for corn is more variable.

[2] Based on a 600-acre farm (193 acres of corn, 220 acres of soybeans, and 187 acres of wheat) that generates a mean gross margin of $125,000 per year. Premiums paid are based on 75 percent coverage and top price options with the government subsidy and reductions for no claims in consecutive years.

To counter the argument that test yields overstate a commercial producer's yields, the test yields were arbitrarily reduced by 20 percent, and yield variability was increased by 10 percent. With these assumptions, the corn yield was below the 74 bushel maximum coverage level only once—58.7 bushels per acre in 1974 when an indemnity of $45.90 per acre would have been collected. Only one indemnity would have been collected on soybeans: $24.50 per acre in 1981. No claims would have been collected on wheat. Over the ten-year period, total claims for the 600-acre farm would have been $14,249, less than half of total premiums paid.

A third evaluation of the area yield coverage plan was carried out using county average yields—103 bushels per acre for corn, 31.4 bushels per acre for soybeans, and 47.6 bushels per acre for wheat. The county average corn yield was below 74 bushels per acre in 1974, and would have generated an indemnity of $39 per acre. An indemnity of $9.80 per acre would also have been paid on soybeans in 1974. Again, no indemnity would have been paid on wheat. For a typical 600-acre farm that was producing county average yields, total indemnities over the ten-year period would have been $9,683 or about one-third of total premiums paid.

The IYC Option and Higher Coverage Levels

In this analysis, it was assumed that the test yields accurately represent the commercial producer's actual yield experience and that all ten years of yield data were documentable for the IYC option. Use of the minimum three-year average currently required by FCIC to qualify for IYC would have given means of 156.6 bushels per acre for corn, 45.4 for soybeans, and 66.8 for wheat. Coverage levels of 75 percent (the current maximum), and the two hypothetical higher coverage levels, 80 percent and 90 percent of mean yields, were examined (see table 4).

From the above average producer's standpoint, the IYC option makes FCIC all-risk insurance more attractive, even at the current 75 percent maximum coverage level with actuarially based, nonsubsidized premiums. It also appears that FCIC coverage could be even more popular if higher coverage levels were offered. Potential utility gains from 75 and 80 percent IYC coverage levels can be calculated by comparing panels B and C with panel A in table 3. At the $125,000 expected gross margin, 75 percent IYC coverage reduces the standard deviation by $3,800—an 8.3 percent reduction from the uninsured base farm plan. These gains occur even though the 75 percent IYC premiums were estimated from the ten-year test yields instead of the subsidized area average premiums the FCIC uses. The 80

Table 4. Premiums, Production Guarantees, and Claims Experience

	75% Area Yield[a]			75% IYC			80% IYC			90% IYC		
	Corn	Soybeans	Wheat	Corn	Soybeans	Wheat	Corn	Soybeans	Wheat	Corn	Soybeans	Wheat
Premium ($/Acre)	6.10	4.80	5.20	9.60	7.60	3.10	11.69	9.78	4.90	18.00	18.80	10.28
Production guarantee (bu/acre)	74	23.5	33	106.0	35.0	48.0	113.9	37.4	52.3	128.0	42.0	57.7
No. of claims, 1972-1981	0	0	0	1	3	2	1	3	2	3	3	3
Ave. indemnity ($/ac/yr)	0	0	0	8.10	7.88	2.00	10.49	13.16	4.97	21.96	22.57	13.62
Ave. premium-Ave. annual indemnity ($/ac/yr)	6.10	4.80	5.20	1.50	(.28)	1.10	1.20	(3.38)	(.07)	(3.96)	(3.77)	(3.39)

[a] Includes 30 percent government subsidy on coverage up to 60 percent.
Price options (1982) were corn $3, soybeans $7, and wheat $4.50.

percent IYC coverage would further reduce the standard deviation by $2,500. The 80 percent IYC coverage would reduce risk by 13.8 percent compared to the base plan. Recall, however, that the soybean premium is less than the actuarially feasible level from the insurer's standpoint at the 80 percent level.

If added administrative costs are not considered, 75 percent IYC coverage is feasible from FCIC's standpoint for corn and wheat and nearly so for soybeans. The 80 percent IYC coverage is actuarially sound for corn and nearly so for wheat. The estimated annual soybean premium was $3.38 per acre less than the average yearly indemnity at the 80 percent coverage level. Average yearly claims would exceed average yearly premiums by a wide margin on all three crops at the 90 percent coverage level.

Summary and Implications

Implications for Producers

Crop producers whose yield experience is represented by the northwest Ohio variety test trials gain little in terms of risk reduction from the FCIC's area yield coverage plan. As noted earlier, no claims would have been collected during the period 1972 to 1981. If crop yields are normally distributed, the probabilities of realizing yields below FCIC's guarantees are only 2.3 percent for soybeans, 1.1 percent for corn, and 0.8 percent for wheat. The 75 percent IYC coverage significantly increases these probabilities to 15.6 percent for soybeans, 11.5 percent for corn, and 10.8 percent for wheat. The MOTAD model results also indicate potential utility gains. Moreover, 75 percent IYC coverage appears to be actuarially feasible from FCIC's standpoint.

Neither the comparison of premiums paid to indemnities received, nor MOTAD generated E-A frontiers completely explain the decision to insure. From the standpoint of the purchaser, insurance is the exchange of a small probability of a large loss for a small but certain loss—the premium. In fact, most buyers of casualty, liability, medical, and other types of insurance probably hope that they never have to file a claim. They buy insurance to protect their income streams and assets against large losses. The same reasoning can be applied to crop insurance. Some farmers buy crop insurance to prevent their incomes from falling below some "disaster" level in any given year, even though the probabilities of receiving indemnities are remote.

Consider the operator of our typical 600-acre crop farm that generates an expected gross margin of $125,000 per year. The MOTAD model results indicate that the standard deviation of this gross margin is $45,500 without crop insurance, $41,700 with 75 percent IYC, and $39,200 with the hypothetical 80 percent IYC coverage. Assuming a normal distribution for the gross margin, probabilities of receiving a gross margin below disaster levels ranging from $30,000 to $120,000 were calculated (see table 5).

The results appear to be at odds with the usual recommendations concerning crop insurance. High disaster levels are usually associated with high debt loads or other fixed financial obligations such as cash rent, wages for hired labor, and so forth. Some lenders encourage or require their highly indebted clients to purchase crop insurance; however, the relative gains in terms of reducing the probability of a disaster by purchasing crop insurance, are negligible at higher disaster levels. For the producer who needs a minimum gross margin of $100,000, for example, buying 75 percent IYC coverage decreases the probability of failure from 0.291 to 0.274—a modest 5.8 percent improvement in the odds of survival. The financially secure operator who needs only $50,000 achieves a relatively large 24 percent improvement in the odds by

Table 5. Probabilities of Realizing Gross Margins Below Disaster Level for a 600-acre Crop Farm With $125,000 Expected Gross Margin.

Disaster Level	No Insurance	75% IYC Insurance	80% IYC Insurance
($000)		Probabilities	
120	.456	.452	.448
110	.371	.359	.352
100	.291	.274	.261
90	.221	.201	.181
80	.151	.140	.125
70	.113	.093	.081
60	.076	.059	.049
50	.050	.038	0
40	.031	0	0
30	.018	0	0

purchasing the same insurance coverage. The insurance program would effectively rule out gross margins below about $43,100 and $50,450 for the 75 and 80 percent IYC coverages respectively. These minimums were calculated by assuming that yields for all three crops were exactly equal to FCIC guaranteed yields (i.e., no indemnities) and that prices were equal to the lowest values observed over the ten-year period. In Robinson's and Lev's terms, probabilities are "piled up" at these minimum amounts.

From the lender's standpoint, crop insurance is an appealing risk-reducing strategy. For the $100,000 disaster level operator, any gross margin below $100,000 implies financial failure of the business. In essence, all incomes below the disaster level are irrelevant to the borrower; however, all disaster levels are relevant for the lender because part of the loan may be recovered (Robinson and Lev). A $50,000 gross margin could result in a $50,000 loan loss on the $100,000 disaster level operation. However, the 75 percent IYC coverage reduces the probability of a loan loss exceeding $50,000 from 5 percent to 3.8 percent and would eliminate loan losses in excess of the minimum gross margins.

Implications for FCIC

The nationwide 75 percent upper limit on coverage appears to be a major impediment to increased participation by above average producers in low-risk farming areas. Conversely, any fixed ratio of coverage to mean yield may be too high in some areas and/or on some crops.

The recent implementation of the IYC and PRY options is an important innovation. These options should be widely publicized and offered because, over time, the yield data base will be enhanced by claims experience. This improved data base could then be used to test the actuarial feasibility of different coverage levels. Admittedly, the results of a case study cannot be generalized; however, they do identify some of the problems encountered in implementing more individualized crop insurance plans. Results of this study indicate that for our case farm 80 percent IYC coverage is probably feasible on corn and wheat, but not on soybeans. Our analysis also indicates that farmers under the IYC option should be charged different premiums than area yield plan participants. The 75 percent IYC premiums calculated from the ten-year variety test yields are substantially higher than area average premiums for corn and soybeans, but substantially lower for wheat. Discrepancies of this magnitude will jeopardize the IYC and PRY programs either through unfavorable claims experience or nonparticipation. Perhaps FCIC should consider using variety tests conducted by state experiment stations and the seed industry as a potentially useful source of additional crop yield data.

The broader questions concerning government's role in mitigating risks in agriculture need to be addressed (Kramer and Gardner). In the past yield and price risks have been addressed by different policies and largely autonomous agencies. The FCIC was created to reduce yield risk. Price risk has been addressed by various price support programs, such as the much publicized 1983 PIK program. The government has also played a major role in risk reduction through the FmHA's emergency loan programs. The combined budget outlays for these three USDA operations are sizable and very unpredictable. Perhaps recent proposals described by Heffernan to combine price and yield protection into a single farm revenue insurance program deserve serious consideration.

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Price-Level-Adjusted Mortgages for Agriculture and Index-Linked Bonds

J.A. Seagraves

Abstract

This article defines index-linked bonds and price-level-adjusted mortgages, explains how an intermediary could borrow money on the one basis and relend it on the other, and is intended to stimulate thought regarding desirability of partially-indexed mortgages. As an alternative, banks could allow use of land as security for cash management accounts or overdrafts.

Key words: index-linked, indexed, mortgages, inflation, cost-flow problems.

Economists have frequently recommended price-level-adjusted mortgages (PLAMs), price-level-adjusted deposits (PLADs), and index-linked bonds (ILBs) as ways to cope with uncertainty about future inflation rates. Writing in *Newsweek*, Friedman has recommended PLAMs and PLADs; however, he devotes many more articles to ways of stopping inflation than to ways of adjusting to it. Kahn has recommended indexing the principal. Helzel and Babbel and Sharplin have also recommended indexed borrowing.

These instruments guarantee lenders that they will be paid back amounts of money that have the same purchasing power as the money that they lent. Conventional bonds and mortgages assign the risk of increased inflation to the lender. It is hard to understand why mortgage contracts have not developed in which the risk of increased inflation is shared by the borrower and the lender. In the 1950s, for example, cities in Finland sold bonds with interest and principal linked to one-half of the change in consumer price index.

Inflation Rates and Interest Rates

Reported inflation rates refer to the past. They are called *ex post* rates by economists, and usually refer to a specific deflator or index. The consumer price index (CPI), for example, is based on a market basket of items that a typical family might have bought during some past base period. The gross national product (GNP) deflator is based on a changing market basket which reflects continual substitution away from items with higher-than-average price increases. Annual GNP deflator rates for recent years are given in the first column of table 1. They vary more than do the four-year

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Table 1. A Comparison of Some Inflation Rates and Mortgage Rates

	Inflation Rates			Mortgage Rates	
Year	Annual GNP Deflator Realized Rates	Long-Term Expected Future Rates[a]	Corporate Aaa Bond Rates[b]	Federal Land Bank Annual Equivalent Rates[c]	Commercial Bank Long-Term Real Estate[c]
1977	5.8	(6.5)	8.1 (1.6)	8.9 (2.4)	9.4
1978	7.3	6.2 (6.5)	8.7 (2.5)	8.8 (2.6)	9.4
1979	8.5	7.3 (7.3)	9.5 (2.2)	9.7 (2.4)	10.7
1980	9.0	8.7 (8.2)	12.0 (3.3)	10.9 (2.2)	13.7
1981	9.0	7.9 (8.7)	15.3 (7.4)	11.8 (3.9)	16.7
1982	6.7	6.8 (8.0)	14.7 (7.9)	13.0 (6.2)	16.7
1983	4.0	6.3 (6.5)	11.8 (5.5)	12.5 (6.2)	14.5
Selected Simple Averages	7.2	7.2 (7.4)	12.4 (5.3)	10.8 (3.7)	13.0

[a] Hoey's results from surveying about 500 decision makers in financial institutions are given. He asks them about their expected future inflation rates over the next ten years. This survey correctly identified the sharp turning point at the time of the election in November 1980. Numbers in parentheses are Sullivan's weighted average of current and recent past-year inflation rates of the GNP deflator where the weights are .4, .3, .2, and .1.

[b] Numbers in parentheses are the difference between corporate bond yields and long-term expected inflation rates.

[c] Averages calculated from LaDue's table 8. His source was Melichar and Balides.

moving average of these same rates given in parentheses in the next column.

Expected future inflation rates pose a much more difficult problem for the economist. Past rates are not good indicators of future rates. Macroeconomic models that take into account changes in the money supply, capacity utilization, foreign exchange, energy supplies, and other variables do a better job of predicting inflation than do past trends. Sometimes economists want to know the average of businessmen's expectations about inflation. Two methods are used to observe such expectations: surveys and the examination of interest rates in both spot and futures markets. Many economists have made successful use of the Livingston survey for expectations of six and twelve months.[1] One lesser-known set of survey results for expected future (ten-year) inflation rates is given in the second column of table 1. These survey results (*ex ante* rates) happen to have the same simple average for the seven-year period as the *ex post* GNP deflators, indicating that they may refer to similar indices. (Naive expected future rates, equal to a weighted average of current and past GNP deflator rates, are given in parentheses. They "missed" the turning point in November 1980, as would have been expected.)

Corporate Aaa bond rates, given in the third column of table 1, also reflect expected future inflation rates, but with a lag. They peaked in 1981 and have come down much more slowly than have the survey results for long-term expected inflation rates. Simple differences between these interest rates and the long-term expected inflation rates in column 2 are given in the parentheses next to the Corporate Aaa Bond rates. At least four factors logically could account for the large increase in these "real rates" from 2.2 percent in 1979 to 7.9 percent in 1982. First, Aaa bond rates are reported before taxes, and a 40 percent marginal tax levy would amount to 3.5 percent out of 8.7 percent in 1979, but 5.9 out of the 14.7 percent in 1982. Second, as inflation rates rose, uncertainty about future inflation rates also rose, contributing to a larger risk premium for inflationary uncertainty in 1982 than in 1979. Third, increased deficit spending and increased borrowing by consumers—caused by increased unemployment—could have caused real rates to rise.[2] Fourth, none of the price indices reflect change in wealth, as has been emphasized by Brown and Santoni. If real rates fall and asset values rise (as may have happened in the recession of 1982), both the CPI and the GNP deflators would underestimate the amount of inflation felt by wealthy people—people who may be disappointed when they have to shop for good investment opportunities after a fall in real rates.

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[1] See Peek and Wilcox as well as Wilcox, and work backward through references to Gibson.

[2] For example, see Elliott

Mortgage rates are given in the last two columns of table 1. Federal Land Bank rates are based on their costs of capital, which are based on a portfolio of Treasury bonds and Treasury bills with an average maturity of slightly more than three years. These "annual equivalent rates" are based on the net amounts borrowed—after subtracting the five or ten percent that the borrower must leave on deposit. Federal Land Bank (FLB) rates peaked at 13 percent in 1982, one year later than Corporate Aaa bonds peaked and two years after the peak of expected inflation rates. The average FLB lending rate for the seven years—10.8 percent—was well below the average long-term Aaa bond rate of 12.4 percent for the seven-year period. Also note that FLB rates were 2.8 percent under the average long-term mortgage rates charged by commercial banks. In effect, the Federal Land Banks pioneered the idea of variable rate mortgages (VRMs). A high percentage of the Commercial Bank loans would have been for fixed-rate mortgages (FRM), as late as 1982. FRM rates suffer two "disadvantages" compared to VRM rates in recent years. Under FRM, borrowers are guaranteed a fixed rate for the whole period of the loan, thereby protecting themselves against inflation; however lenders often are not protected against borrowers repaying loans if inflation and interest rates fall. The cost of this lopsided privilege is reflected in higher mortgage rates. In addition, FRMs involve a higher risk premium for uncertainty about expected future inflation rates. Banks have to borrow long in order to lend long or else they must charge a risk premium for borrowing short and absorb the risk of lending long themselves. In contrast, VRMs are long-term contracts in which the intermediaries simply promise to pass future short-term interest rates (and short-term expected inflation rates) onto the borrowers. The risk premia of long-term bonds are thereby avoided. Also, borrowers with VRMs will not be likely to refinance their mortgages in a period of disinflation; thus they avoid the premium for the lopsided guarantee inherent in FRMs.

People are now so aware of the average interest rate advantage of VRMs over time, and of the fact that VRMs assign the risk of fluctuations in short-term interest rates (and short-term expected inflation rates) to the borrowers, that there is a tendency to confuse them with price-level-adjusted mortgages, PLAMs, or to assume that the VRMs have the advantages of PLAMs. This assumption is not true. PLAMs should be thought of as real-rate loans starting off at three or four percent, with payments determined by the total elapsed inflation from the date of the loan. Besides having a much gentler repayment schedule in early years of the loan (being less "front-end loaded"), PLAMs might have a large tax advantage to borrowers in high marginal tax brackets.

Index-Linked Bonds

If a bank or the FLB were to issue PLAMs, which might involve a commitment to lend money for a long period of time at a real rate of about four percent, that intermediary would want to borrow money on similar terms, but at a real rate of about three percent. It probably would issue an index-linked bond (ILB). This section provides a definition and an illustration of an ILB and compares it with a conventional 11.75 percent nonlinked bond. The next section compares a PLAM with a conventional mortgage.

An ILB involves choosing an index—say the GNP deflator (of the new CPI)—and a base quarter (or month) prior to the date of issue on which all future payments will be based. If the first interest payment will be due six months after a bond is issued, and if interest payments need to be known in advance to facilitate transfer of bonds among persons (assume that sellers are to be reimbursed exactly for interest they have accrued to the date of sale), then it may be logical to pick a base quarter that falls two full quarters before the bond is issued.[3] For example, if the GNP deflators are announced in March, June, September, and December, and a bond is going to be issued in October, then basing it on the GNP deflator for March will allow investors to know the rate of inflation from March to September. Knowing the rate of inflation will permit them to calculate the interest that will be due the following April. If a 30-year bond were to be issued in October 1985 and were to be based on the GNP deflator of March 1985 (say 230), then the redemption value of the bond would be based on the GNP deflator for March of 2015 (assume that it is 1321). The ratio of 1321 to 230 is 5.7435, and it equals $(1.06)^{30}$, impling a six percent annual rate of inflation. The bond, which will sell for about $1,000 in October 1985, would be redeemed in October 2015 at exactly $5,743.50, plus interest for the last six months. Assuming that it is a three percent bond paying 1.5 percent every six months, the interest payment would always be .015 times the value of the bond at the end of each interest period. For the last period it would be .015(5743.50) or $86.15.

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[3] The British Treasury issues index-linked bonds based on the retail price indices eight months prior to the date of issue, plus the changes in the index between that date and dates eight months prior to each payment and to redemption.

Table 2 provides an assumed set of inflation rates for a 30-year period, plus annual payments for an 11.75 percent conventional bond and payments for a comparable three percent index-linked bond[4]. How can we say that the yields on these bonds are comparable? We assume that the average annual compounded rate of inflation is 6.846 percent and that lenders demand 1.5 percent extra when they must bear the risk of increased inflation[5]. In other words, we justify the 11.75 percent coupon on the conventional bond by combining these assumptions using the compound interest formula:

$$\begin{array}{ccccccc} \text{one plus} & & \text{one plus} & & \text{one plus} & & \text{one plus} \\ \text{the} & \times & \text{the} & \times & \text{the} & = & \text{the} \\ \text{real} & & \text{inflation} & & \text{risk} & & \text{nominal} \\ \text{rate} & & \text{rate} & & \text{premium} & & \text{rate} \\ (1.03) & \times & (1.06846) & \times & (1.015) & = & (1.1170) \end{array}$$

The nominal interest cost of $117.50 per year for the conventional bond covers, in a sense, the expected year-by-year deterioration in real value of the principal. It is not until the twenty-third year that the interest payments for the ILB begin to exceed those of the conventional bond. The simple sum of the interest payments for the ILB, $2,550, is only 72 percent of the sum of the 30 payments of the conventional bond. The final redemption value of $7,290 for the ILB may seem formidable, but remember that it represents the same purchasing power as did the original $1,000 30 years earlier. The simple sum of the amounts paid back in the case of the ILB, $10,060, is 2.3 times greater than the amount paid back on the conventional bond; however much more money is being borrowed toward the end of this loan.

One way to compare widely different sums paid at different times is to calculate present values based on one set of discount rates. Present values are given in the last row of table 2 and in table 3. The discount rates used to calculate these present values are the anticipated inflation rates for each year plus 2.5 percent (assumed to represent the short-term opportunity costs of capital). The average discount rate for the 30-year period is 9.34 percent, which is less than the yield of the conventional bond. Hence, the present value of the money that must be paid back, $1,260, is greater than the $1,000 lent. The present value (or cost) of the ILB is only $1,150. Other discount rates could be used to calculate present values. At a rate of 11.75 percent, the conventional bond would have a cost of $1,000, and the ILB would cost less than $1,000. At a discount rate of 8.1 percent (the Fisher rate), both bonds have the same present value.

Besides comparing the pattern of payments, amounts borrowed, and the present values of these two bonds, we should (1) note the differences in present values after taxes; (2) note the differences in risks to the lender; and (3) consider making the durations rather than the maturity dates comparable. The increases in principal on an ILB due to inflation are not actually paid by the borrower until the bond matures; nevertheless it is easy to calculate the change in the redemption value each year. It would be advantageous for the borrower to consider these increases in liabilities as expenses for tax purposes. After considering

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[4] This example is a modification of one used by Helzel and Babbel and by Sullivan.

[5] Sullivan develops this argument and the rationale for the 1.5 percent risk premium. The risk premium is estimated from the term structure of interest rates (yields on T-bonds and T-bills) one year ahead from the futures market. The futures market is used because it is highly liquid and offers homogeneous "commodities" that are standardized substitutes for actual bonds and bills. By going one year ahead, we avoid the swings in nearby short-term rates. From September 1981 to September 1983, this term structure fluctuated from about zero to 2.5 percent and averaged about 1.5 percent. If we assume no term structure in expected inflation rates and no term structure in real rates, then most of this 1.5 percent must be explained as a risk premium. At best, this is a very rough way to estimate the difference in the yield of conventional and index-linked bonds. See Weiner and a recent book by Dornbush and Simonsen.

Table 2. A Hypothetical Example of a Conventional and an Index-Linked Bond Based on Assumed Future Inflation Rates: Cash Flows and Present Values

		Annual Costs of Borrower Before Tax Deductions for:			
Year	Assumed Annual Inflation Rates[a]	Conventional 11.75% Bond	Index-Linked 3% Bond[b]	Annual Gains in Value of Indexed Bond	Cash Flows for Indexed Bond after Taxes of 50% Are Paid[c]
0	.083	−1000.00	−1000.00	——	−1000.00
1	.079	$117.50	32.49	83.00	−25.26
2	.069	117.50	35.05	85.56	−25.25
3	.095	117.50	37.48	80.63	−21.58
4	.103	117.50	41.04	118.67	−38.82
5	.084	117.50	46.26	140.89	−47.81
6	.078	117.50	49.06	126.74	−38.84
7	.071	117.50	52.89	127.57	−37.34
8	.066	117.50	56.65	125.18	−34.26
9	.050	117.50	60.38	124.62	−32.12
10	.041	117.50	63.40	100.64	−18.62
11	.063	117.50	66.00	86.65	−10.32
12	.010	117.50	70.16	138.61	−34.22
13	−.025	117.50	70.86	23.39	+23.74
14	.004	117.50	69.09	−59.05	+64.07
15	.027	117.50	69.37	9.21	+30.08
16	.040	117.50	71.24	62.43	+4.40
17	.048	117.50	74.09	94.99	−10.45
18	.060	117.50	77.65	118.55	−20.45
19	.075	117.50	82.31	155.30	−36.50
20	.081	117.50	88.48	205.77	−58.64
21	.115	117.50	95.65	238.90	−71.62
22	.129	117.50	106.65	366.65	−130.00
23	.144	117.50	120.40	458.58	−169.09
24	.100	117.50	137.74	577.94	−220.10
25	.080	117.50	151.52	459.14	−153.81
26	.070	117.50	163.64	404.04	−120.20
27	.073	117.50	175.09	381.82	−103.36
28	.068	117.50	187.87	426.06	−119.09
29	.090	117.50	200.65	425.85	−112.60
30	.083	117.50	218.71	601.95	−191.62
Redemption Value in 30th Year		1000.00	7290.25	——	7290.25
Total Payment in 30th Year		1117.50	7508.96	——	7019.63
Simple Sum of Amounts Paid Back		4525.00	10,060.00	——	5430.57
Present Value of Amounts Paid Back[d]		1260.00	1150.00	——	151.00

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[a] These are the same as the inflation rates assumed by Helzel and Babbel (*op. cit.).* The average annual compounded rate is .068459, regardless of whether one goes from year zero to 29 or year one to 30.

[b] The inflation rate for year zero is assumed to refer to the year ending a month before time zero, the date when the bond is issued. A lag is assumed so that interest on the index-linked bond for the next payment period can be calculated in advance. The first interest payment is made at time one (the end of year zero or the beginning of year one). Interest payments pertain to money borrowed during the preceding period, but the payments are based on the end-of-period redemption value of the bond. For example, the value of the bond at the beginning of year one is $1,083 because the inflation rate for year zero was .083. The interest due at time one is three percent of $1,083, or $32.49. The gain in the value (or the liability) of the bond during the preceding year is listed in the next column.

[c] The interest payments are reduced by 50 percent, and 50 percent of the annual gains in the value of the indexed bond are subtracted, resulting in annual costs to the borrower which are usually negative.

[d] The reason that these present values are not exactly equal to the amounts borrowed ($1,000), as would be true of *ex ante* present values, is that these are *ex post* calculations based on pretending knowledge of inflation rates 30 years into the future to calculate present values for year zero. The discount rates used to calculate present values were the inflation rates for the year ahead plus .025. To discount payments from time one to present values at time zero, 10.4 percent (from .079 + .025 = .104) was used.

Table 3. After-Tax Present Values of Repayments for the 30-Year Conventional Bond from Table 1 and Comparable Index-Linked Bonds with 30-Year and Shorter Maturities

		Index-linked bonds with the increase in principal deducted as an expense each year		
Item: Marginal tax rate	**Conventional 30-year bond**	**30-year bond**	**15-year bond**	**10-year bond**
Present values in year zero:[a]				
Zero	1260	1150	1127	1058
25 percent	962	651	852	850
50 percent	664	151	577	643
Durations:[b]				
Zero	8.7	20.8	12.5	8.8
25 percent	9.1	26.4	14.5	9.7
50 percent	9.8	(30)[c]	(15)[b]	(10.0)[c]

[a] See footnote d of table 2 for explanation of discount rates used.

[b] The "duration" of the repayments is the weighted average year in which the repayments are made. The weights are the ratios of the present values of each repayment to the present value of all repayments.

$$\text{Duration} = \sum_{t=1}^{T} t\, A(t) \Big/ \prod_{t=1}^{t} (1 - d(t)) \div \sum_{t=1}^{T} A(t) \Big/ \prod_{t=1}^{t} (1 - d(t))$$

where t indicates the year, A(t) is the after tax payment in each year, and Π indicates the product of the annual discount rates d(t) which are defined in footnote d of table 1.

[c] The number in parentheses is the maturity (years) of the bond. The formula for duration given in footnote b results in a duration that is longer than the maturity so the latter is used.

alternative ways that the increase in principal could be deducted (either as expenses each year or as an expense or a capital loss in the final year), the author concluded that the IRS would accept as annual expenses these increases in liabilities for borrowers reporting on an accrual basis.[6] Also, annual expensing is consistent with treatment of zero coupon bonds under TEFRA.

A long-term index-linked bond would have a tremendous advantage over a conventional bond for borrowers in a high marginal tax bracket. Note in the second column of table 3 that the present value or cost of $15 per $1,000 borrowed on the ILB is less than one-fourth the cost of the conventional bond, and about one-eighth of the value of the same bond to someone in the zero tax bracket. These figures make it very difficult to explain why ILBs have not been used and why their tax status has not been clarified.

If there is any risk of default, then the two 30-year bonds would have different risks to the lender. The lender who buys an ILB is gradually lending more nominal dollars until the date of maturity; hence his exposure in the event of default is greater. At the same time, the purchasing power of what he loans is protected from the ravages of increased inflation. If there is no risk of default, then the ILB is the less risky of the two bonds. At some level of default and inflation risk, the two bonds are equally risky. With high levels of default risk, no one would consider ILBs.

Killingsworth suggested that the "durations" of the two bonds should be made comparable, rather than their maturities. Duration is defined here as the weighted average year in which the money is returned. (For a precise definition, see footnote b of table 3.) The duration of the 30-year conventional bond with zero taxes is 8.7 years, as opposed to 20.8 years for the ILB.

The longer duration of an ILB is mainly an advantage when it is first introduced. Delayed repayment schedules would be important to beginning farmers with "cash flow" problems and to countries that must consolidate all their borrowing into one big loan. The advantage of longer durations evaporates when a series of ILBs is maturing regularly or being "rolled over" into new loans. Note that in the final column of table 2 where the increases in liabilities are expensed each year and the 50 percent tax bracket is assumed, the net costs of the loan to the borrower are negative in 26 of the 30 years; the duration of the loan is effectively 30 years.

Table 3 also shows the present values and durations of ILBs that mature in 10 and 15 years. The 10-year ILB has about the same duration as the 30-year conventional bond at these interest rates. Equalizing durations completely wipes out the tax advantage of ILBs to borrowers. At high tax rates, the ILBs no longer have lower present values than the conventional bonds. This is because as the duration is shortened, redemption values gain in importance relative to the deductible

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[6] See Seagraves.

Table 4. Repayment Schedules for a Four Percent 30-year Mortgage and for a Price-Level-Adjusted Mortgage Based on It

	4% Conventional Mortgage-No Inflation				Compounding Factors for Inflation, 1 Plus the Cumulative Rate[a]	Price-Level-Adjusted Mortgages				
Year	Total Annual Payments	Interest Payment	Principal Payment	Principal Balance		Total Annual Payment	Interest Payment[b]	Principal Payment[b]	Principal Balance[c]	Increase in the Value of the Principal[d]
0	——	——	——	1000.00	1.00000	——	——	——	1000.00	——
1	57.83	40.00	17.83	982.17	1.08300	62.63	43.32	19.31	1063.69	83.00
2	57.83	39.29	18.54	963.63	1.16856	67.58	45.91	21.67	1126.05	84.03
3	57.83	38.54	19.28	944.34	1.24919	72.24	48.15	24.09	1179.66	77.70
4	57.83	37.77	20.06	924.29	1.36786	79.10	51.67	27.43	1264.29	112.07
5	57.83	36.97	20.86	903.43	1.50875	87.25	55.78	31.47	1363.04	130.22
6	57.83	36.14	21.69	881.73	1.63548	94.58	59.10	35.48	1442.06	114.50
7	57.83	35.27	22.56	859.17	1.76305	101.96	62.18	39.78	1514.77	112.48
8	57.83	34.37	23.46	835.71	1.88823	109.20	64.89	44.30	1578.01	107.55
9	57.83	33.43	24.40	811.31	2.01285	116.40	67.29	49.12	1633.04	104.15
10	57.83	32.45	25.38	785.93	2.11350	122.22	68.59	53.64	1661.06	81.65
11	57.83	31.44	26.40	759.54	2.20015	127.24	69.17	58.07	1671.09	68.10
12	57.83	30.38	27.45	732.09	2.33876	135.25	71.05	64.20	1712.18	105.28
13	57.83	29.28	28.55	703.54	2.36215	136.60	69.17	67.43	1661.87	17.12
14	57.83	28.14	29.69	673.85	2.30309	133.19	64.81	68.38	1551.95	−41.55
15	57.83	26.95	30.88	642.98	2.31230	133.72	62.33	71.40	1486.76	6.21
16	57.83	25.72	32.11	610.87	2.37474	137.33	61.08	76.26	1450.65	40.14
17	57.83	24.43	33.40	577.47	2.46973	142.82	60.35	82.48	1426.19	58.03
18	57.83	23.10	34.73	542.74	2.58827	149.68	59.79	89.89	1404.76	68.46
19	57.83	21.71	36.12	506.62	2.74357	158.66	59.56	99.10	1389.94	84.29
20	57.83	20.26	37.56	469.05	2.94934	170.56	59.77	110.79	1383.40	104.25
21	57.83	18.76	39.07	429.99	3.18823	184.38	59.82	124.56	1370.90	112.06
22	57.83	17.20	40.63	389.36	3.55488	205.58	61.14	144.44	1384.11	157.65
23	57.83	15.57	42.26	347.10	4.01346	232.10	62.51	169.59	1393.07	178.55
24	57.83	13.88	43.95	303.15	4.59140	265.52	63.75	201.77	1391.90	200.60
25	57.83	12.13	45.70	257.45	5.05054	292.07	61.24	230.83	1300.26	139.19
26	57.83	10.30	47.53	209.92	5.45458	315.44	56.17	259.27	1145.01	104.02
27	57.83	8.40	49.43	160.48	5.83640	337.52	49.01	288.51	936.65	80.15
28	57.83	6.42	51.41	109.07	6.26246	362.16	40.20	321.96	683.07	68.38
29	57.83	4.36	53.47	55.61	6.68830	386.78	29.18	357.60	371.91	46.45
30	57.83	2.22	55.60	−0.00	7.29025	421.60	16.22	405.38	−0.00	33.47
Simple sums			1000.00					3638.20		2638.20
Present Values	1268[e]	561[e]	649[e]			1312[f]	580[f]	674[f]		876[f]

[a] The products of one plus the assumed annual inflation rates from table 2.

[b] The cumulative inflation factor times the corresponding earlier columns for the four percent conventional mortgage.

[c] New outstanding balances are the balance due in the preceding year times one plus the inflation rate for that year from table 2 minus the principal payment.

[d] The annual increase in the balance due is simply the preceding year's balance times the interest rate for that year from table 2.

[e] Based on an assumed annual discount rate of .025 or a discounting factor of $1/(1 + .025)^t$.

[f] Present values are found using the same annual discount rates as in table 2—the inflation rates for each year plus .025.

interest and losses on principal. It might seem as though the 10-year ILB has practically no advantages over the 30-year conventional bond. That conclusion is not valid. The ILB would still have much gentler cash flow requirements for the borrower in the early years, and it would still insulate the lender from the vicissitudes of rising inflation rates.

Price-Level-Adjusted Mortgages

A PLAM is a mortgage. As such, it is gradually amortized over the life of the loan. The first three columns of table 4 list total annual payments, interest payments, and principal payments for the amortization over a 30-year period of a $1,000 loan at four percent. This real rate of four percent would be a reasonable mortgage rate if no inflation were expected. Therefore, it is a reasonable basic real rate for a PLAM. The same inflation rates assumed in table 2 are used to calculate the compounding factors for inflation which are listed in column 5 of table 4. These inflation factors for each year are multiplied by the first three columns of table 4 to obtain the corresponding three series for the PLAM with inflation (see columns 6, 7, and 8). The principal balance in column 9 increases gradually until the twelfth year of the loan and then declines. The increase in the amount of the loan might be disconcerting to a banker who is preoccupied with collateral. Presumably, however, land values would also be increasing, and the banker would be reporting to the borrower each year the precise increases in the value of his debt due to inflation (column 10)—as well as interest payment, payment toward principal reduction, and net principal due.

Table 5. Present Values and Durations of Conventional and Price-Level-Adjusted Mortgages

	Conventional Mortgages		PLAMs	
Item	(FRM) 12.787%	(VRM) 11.12%	4% plus cumulative inflation[a]	4% with no inflation
Annual Payments	$131.42	$116.11	$62.63 to 421.50	$57.83
Present values of repayments for a borrower in these marginal tax brackets:[b]				
Zero	1465	1293	1312	1268
25%	1174	1045	948	1128
50%	883	797	584	988
Durations of the mortgages given these marginal tax brackets:				
Zero	9.1	9.1	13.1	13.0
25%	9.2	9.2	14.3	13.4
50%	9.3	9.4	17.1	13.8

[a]This PLAM is defined in the last five columns of table 4.

[b]See footnote d of table 2.

Let us assume that the Internal Revenue Service agrees that annual increases in the value of one's debt due to inflation (column 10) may be considered expenses for income tax purposes. Only part of these increments is being repaid during the first twelve years, but principal payments exceed the increases in principal in most of the subsequent years. The important consideration—from the standpoint of the IRS—is that the original $1,000 borrowed is not being "expensed." The sum of the principal payments in column 8 is exactly $1,000 more than the sum of the annual increments in column 10. However, the time pattern of these series is quite different. Note, in the last row of table 4, that the present value of the tax-deductible increases in value due to inflation, $876, exceeds the present value of principal payments, $674.

Continuing this game of pretending that we know inflation rates 30 years into the future—or that we know that the average annual rate will be 6.846 percent—what interest rates should we assume in order to devise comparable conventional mortgages? In table 5 we have assumed that 12.787 percent is a comparable rate for a conventional fixed-rate mortgage, and that 11.12 percent would be a comparable average rate over the 30 years for a variable rate mortgage, or VRM.[7]

Again, the borrower and lender will use several different criteria in deciding which of these mortgages each prefers. Yield and risk are once again the paramount considerations. The yields to the lender are 12.787 percent for the fixed-rate mortgage, and 11.12 percent for the variable rate mortgage and the PLAM. As the lender's yield declines, so does his risk. The opposite is true for the borrower; as he obtains a lower interest rate, he assumes more of the risk of higher inflation rates in the future.

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[7] The *ex post* yields on the PLAM and the VRM are assumed to be the same—11.12 percent (1.04 × 1.6846 = 1.1112). The yield on the FRM (12.787 percent) is assumed to include a risk premium of 1.5 percent. It is derived from 1.1112 × 1.015 = 1.12787.

The present values emphasize exactly what we saw earlier—that index linking would have great advantages to a borrower who is in a high marginal tax bracket. In the zero tax bracket, the present value of the amounts repaid on the VRM is $1,293, as opposed to $1,312 for the PLAM; therefore the VRM would be slightly preferred.[8] However, a borrower in the 50 percent tax bracket would reap a $213 per $1,000 advantage in terms of present values by using a PLAM instead of a VRM ($797 - $584 = $213).

The durations of the conventional mortgages shown in the lower portion of table 5 are similar to the durations of the conventional 30-year bond shown in table 3. Basically, if interest rates are above ten percent, it is difficult for a conventional loan—even one of 100 years—to have a duration of more than about ten years. This is not true of PLAMs. They would have about the same duration regardless of the inflation rate (ignoring taxes). PLAMs do have much shorter durations than ILBs, because in the case of the ILB, none of the principal is repaid until the end of the loan. If the Federal Land Bank wanted to issue ILBs with durations that were comparable to the durations of 30-years PLAMs, it would probably choose 15-year ILBs.

What type of farmer would be expected to prefer PLAMs over conventional VRMs? The answer: risk-takers in high brackets who have a cash-flow problem. Of course, banks may be reluctant to make long-term real rate loans unless they have good collateral that will increase in value with the amount borrowed.

Why Haven't PLAMs and ILBs Been Used in the United States?

At the same time that many economists have been recommending PLAMs, others have been asking why they haven't already been used.[9] What follows is a set of tentative answers to this question.

Inflation may not have been volatile enough to cause people to diligently seek ways to protect themselves against it. As long as we were on some form of the gold standard—or until 1968—long-term expected inflation rates generally were less than two percent. Now, in early 1984, my long-term expected inflation rate is six percent with a standard deviation of five percent.[10] The higher the volatility of inflation rates, the greater would be the demand for PLAMs. If inflation and its standard deviation drop to zero, there will be no risk premium and no need for PLAMs or ILBs.

The time may never have been right for index-linked bonds in the United States. Real rates expected on nominal contracts may have been too high in 1981-1982 and too low from 1934 to 1980.[11] If we assume that ILBs would need to have a coupon offering a real three percent before taxes, and we add a risk premium of 1.5 percent, then the expected real return on long-term nominal bonds ought to be about 4.5 percent—say four to five percent—in order for both ILBs and conventional bonds to sell in competition with one another. If fact, 1983 and early 1984 may be characterized by expected real rates before taxes in this range.[12]

Not enough incomes are indexed in the United States. The more that borrowers' net incomes are indexed, the more they will be willing to use PLAMs. The more lenders' incomes are indexed, the less enthusiastic they will be about indexed lending. The more that incomes and prices are indexed, the lower will be the real rate paid on PLAMs and the larger will be the risk premium between the nominal yield on conventional mortgages and the realized yield on PLAMS.

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[8] I did not actually hypothesize a set of variable rates over the 30-year period. Such a hypothesis would be rather complicated, since one would have to decide how to derive comparable variable rates. They are much smoother than inflation rates (see table 1). Also, the schedule of principal payments is being changed every time the contract rate changes for the VRMs issued by the Federal Land Banks.

[9] Another group is saying that the benefits of indexed financial instruments have been exaggerated.

[10] My standard deviation refers to annual rates which I expect to see over the next 30 years. It corresponds to a range from zero to 20 percent.

[11] According to McCullock, the "Gold Clause" in the Joint Congressional Resolution of June 5, 1933, effectively made index-linked contracts illegal until October 1977 when "Congress, thinking it was merely humoring a handful of 'gold bugs,' passed the Helms Amendment which revoked the 1933 Joint Resolution." For a different interpretation, see Rosenn, "Protecting Contracts from Inflation," *The Business Lawyer* (January 1978), pp. 740-741.

[12] Hoey subtracts his 10 years expected inflation rates from ten-year T-bond yields. His real rates are: September 1978-October 1980, below 2.68 percent; January 1981, 4.32 percent; May 1981-September 1982, above 5.61 percent; December 1982, 3.94 percent; March 1983, 4.15 percent.

No appropriate price index exists. Cukierman reminds us that increased volatility of overall inflation rates is usually associated with increased volatility among real prices. Thus a price index that is attractive to borrowers may not suit lenders, and vice versa. Brown and Santoni remind us that none of our price indices accurately reflects changes in wealth.

There are too many good alternatives. Bodie, Kane, and McDonald develop the argument that short-term T-bills provide investors with extremely low-risk asset. Real yields are almost constant. Borrowers using VRMs are avoiding the risk premium for inflation inherent in long-term rates. Lenders have an effective substitute for ILBs that protects them from inflation.

Start-up costs are high. These costs could include uncertainty about how increases in principal will be taxed, higher interest rate payments because the buyers of ILBs would not be competitive at first, and the cost of designing and advertising the instruments. Perhaps there is "determined resistance" to PLAMs and ILBs in the financial markets, but that notion cannot be true if these markets are highly competitive. One of the purposes of this article is to reduce start-up costs by stimulating discussion of PLAMs.

The author is asking the same question in England. There, most farmers that do borrow use overdrafts with commercial banks for both short- and long-term financing. They pledge their farms as collateral for these indefinite-term callable loans with completely flexible repayment schedules. Four large banks compete in terms of how much more than the base (prime) rate they will charge an individual farmer. Overdrafts also have the advantage of allowing income-tax deductions of interest even in years when no interest is paid. Overdrafts and direct placements have virtually eliminated the issue of new corporate bonds. In effect, there appears to be little need for PLAMs in Great Britain.[13]

Conclusions

Farmers have been well-served by the variable-rate mortgages of the Federal Land Banks. But farmers with low equities may need gentler repayment schedules during the early years of their loans than is customary under existing mortgages. Flexible use of refinancing and grace periods is used to provide relief on a case-by-case basis. Price-level-adjusted mortgages would provide a more rational long-run solution to the cash-flow problems caused by inflation, especially for firms with low equity and low rates of real growth. I think the Federal Land Banks should consider experimenting with mortgages that are 50-50 combinations of PLAMs and VRMs.

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[13] See Rutherford. Also, Hill emphasized the need for noncallable loans that will help farmers with a cash-flow problems. Conventional loans may require the borrowers to make burdensome repayments of real principal in the early years of a loan. In an example, he assumes: (1) a project (machine) with a known annual real return of five percent and various expected lifes, (2) nominal returns to retire the maximum possible amount of the cost each year, and (3) inflation rates of zero and fifteen percent. Inflation creates no problem. The pattern of repayments would be identical for a farmer using an overdraft and a PLAM. This is, of course, not true with a conventional loan in which nominal interest must be paid on schedule. A project that is feasible in real terms is rendered infeasible under inflation by the forced annual retirement of the real loss of principal implicit in high nominal interest rates.

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The Impact of Recent Tax Legislation and Inflation on the Taxation of Farm Capital

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Abstract

This article analyzes the impacts of recent tax law changes and reductions in the rate of inflation on incentives for investment in farm capital. At present, effective tax rates on income from farm capital are well below those of 1980. The primary reasons for this decline are the drop in the rate of inflation and the statutory tax rate reductions contained in the Economic Recovery Tax Act of 1981 (ERTA). The changes in the capital cost recovery system contained in ERTA and the subsequent modifications of that system had only a slight impact on effective tax rate levels.

Key Words: Effective tax rate, ACRS, inflation, statutory tax rates, ADR, ERTA, TEFRA, capital cost recovery system.

During the latter part of the 1970s, inflation combined with the progressive federal income tax structure to increase individual income tax burdens substantially. By 1980, the percentage of household income that was paid in federal income taxes was greater than at any other time in recent decades (U.S. Congress, 1981a). In that year, the average income tax rate for individuals with farm earnings was 20 percent, a sharp increase over the 1971 average of less than 14 percent (U.S. Department of the Treasury, 1971, 1980).

In 1981, Congress responded to this rising tax burden by enacting the Economic Recovery Tax Act (ERTA), the largest tax cut in history. Among the more significant changes in personal income and business tax laws included in the act were multiyear statutory tax rate reductions, an indexing provision for tax brackets and personal exemptions, and a new capital cost recovery system, the Accelerated Cost Recovery System. This substantial tax cut was followed by the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), a measure to increase tax revenues. TEFRA scaled back several of the tax provisions enacted under ERTA, including various provisions of the Accelerated Cost Recovery System.

This paper evaluates the impact of these recent tax law changes and reductions in the rate of inflation on incentives for investment in farm capital. The first and second sections of this paper briefly describe the data and procedures used to generate the estimates discussed in the remaining sections. Our estimates of the individual and combined effects of tax law changes and inflation on incentives for investment in depreciable farm capital for the period 1980-1984 are presented in section

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three. The final section summarizes the conclusions of our analysis.

Estimation Procedures

One method of summarizing the impact on investment incentives of changes in the capital cost recovery system, statutory tax rates, and the rate of inflation is by calculating effective income tax rates for farm capital. Effective tax rates measure the fraction of the gross rate of return on investment that accrues to the government. They can be compared with statutory tax rates to determine whether income from capital is being sheltered from taxes or taxed at rates higher than statutory rates due to the effects of inflation on the real values of depreciation deductions and tax credits.

Following Auerbach and Jorgenson, Hulten and Wykoff, and others (Gravelle; U.S. Congress, 1981b), we define the effective income tax rate to be the percentage difference between the before-tax and after-tax rates of return on capital. We let *s* be the real before-tax rate of return on capital, and *r* the real after-tax return. The effective tax rate is e = (s-r)/s. For each private dollar that is invested in capital, the government earns a return of (s-r) in the form of tax collections. The effective tax rate is the government's return expressed as a fraction of the before-tax return.

We assume that profit-maximizing farm operators adjust the sizes of their stocks of the various types of farm capital until all types earn the same after-tax rate of return. We hold the return constant for all assets and all years. Using information concerning the economic characteristics of each asset, and the treatment of its income by the existing tax system, we estimate the gross income that each asset would be required to earn to provide its owner with the given after-tax return. We use this gross income to compute the asset's before-tax rate of return.

We assume that each new unit of capital is produced and sold at a real price of q. We let a_t be the units of capital service that are provided by a unit of capital in its *tth* year of service, with $a_1 = 1$, and $1 \leq t \leq n$, where *n* is the asset's economic life. Salvage value is assumed to be zero. We let *c* be the real gross income that is earned by each full unit of capital service, and we refer to *c* as the implicit rental price of capital. The rental price is the gross rental rate that would need to be charged by an investor earning the after-tax return *r*. Each unit of capital earns a gross income of *c* when new, and an income of ca_t in its *tth* year of service. The rental price *c* is a function of the price of capital (q), the after-tax rate of return (r), and the income tax system.

Our formula for the rental price of capital is

$$c = \frac{q}{\sum_{t=1}^{n} a_t(1+r)^{-t}} \; \frac{1 - \bar{K} - u(1-yk) \sum_{t=1}^{m} z_t(1+r)^{-t}(1+i)^{-t}}{(1-u)} \qquad (1)$$

where *u* is the statutory tax rate; *i* is the rate of inflation; k and k are the statutory and effective rates of the investment tax credit, respectively, with $\bar{k} = k/[(1+r)(1+i)]$ to reflect our assumption that the credit is not claimed until one year after the asset is purchased; y is the percent of the tax credit that must be deducted from each asset's purchase price to obtain the tax depreciation base; z_t is the fraction of the depreciation base that is claimed as a tax deduction in the asset's *tth* year; and *m* is the tax life of the asset. A complete derivation of this formula is available from the authors upon request.

The before-tax rate of return is the real discount rate *s* that produces an equality between the purchase price of a unit of capital and the present discounted value of the real gross income that the unit will earn. It is the *s* that is a solution to the equation.

$$q = \sum_{t=1}^{n} ca_t(1+s)^{-t} \qquad (2)$$

We estimate *c*, the rental price of capital, and then we solve equation (2) for *s* by searching for the value that satisfies the equation. The before-tax and after-tax returns are then used to compute the effective income tax rate.

Assumptions

The capital stock of the farm sector is composed of many different types of farm equipment and structures. Many of these capital assets, however, have similar economic and tax characteristics. Thus, to simplify the estimation task, all depreciable farm equipment and structures were divided into five categories: motor vehicles, farm machinery, crop storage structures, unitary livestock structures, and multipurpose structures. The economic and tax characteristics of the assets within each category were assumed to be identical. Thus, only five separate series of estimates of effective tax rates were used to represent all farm equipment and structures.

The average economic lives of the assets in each category were determined by using averages of Bulletin F depreciation lives (U.S. Department of the Treasury, 1942). These economic lives are: motor vehicles, 6 years; farm machinery, 15 years; crop storage structures, 25 years; and unitary livestock structures and multipurpose structures, 50 years.

All assets were assumed to exhibit the same concave pattern of decline in service capacity:

$$a_t = 1 - [(t - 1)/n]^2 \qquad (3)$$

where t is the age of the asset, a_t is the amount of service capacity remaining at age t, and n is the asset's economic life.

Our estimates of effective tax rates apply to marginal (additional) investments and are therefore functions of the highest statutory rate at which an investor's income is taxed. Larger incomes are generally taxed at higher rates. We computed separate estimates of effective tax rates for investors having taxable incomes of $15,000 and $60,000 in 1980. Taxable incomes for 1981-1984 were adjusted to maintain the same real income over the five-year period. The adjusted income levels and corresponding marginal statutory tax rates are presented in table 1. These rates reflect the statutory tax rate reductions contained in ERTA.

Table 1. Taxable Incomes and Marginal Tax Rates, 1980-1984

	Low-income investor		High-income investor	
Year	Taxable income	Marginal tax rate	Taxable income	Marginal tax rate
	Dollars	Percent	Dollars	Percent
1980	$15,000	21	$60,000	54
1981	$16,556	24	$66,224	50
1982	$17,571	22	$70,284	49
1983	$18,221	19	$72,885	44
1984	$18,913	18	$75,655	42

Permissible methods for computing tax depreciation deductions have varied over time and by asset. We employed those methods that maximized the real present values of tax depreciation deductions and thus minimized effective tax rates. Under the old Asset Depreciation Range System (ADR) effective in 1980, the present values of tax depreciation deductions for motor vehicles, farm machinery, and crop storage structures were maximized by using the sum-of-the-years' digits method (with additional first-year depreciation of 20 percent) and the minimum permissible tax lives of six, eight, and eight years, respectively. The present values of deductions for other farm structures were maximized by using the 150 percent declining-balance method and a tax life of 20 years. Beginning in 1981, the present values for all assets were maximized by using the new tax depreciation schedules and minimum tax lives contained in ERTA. The new minimum tax lives are three years for motor vehicles, five years for farm machinery, crop storage structures, and unitary livestock structures, and 15 years for multipurpose structures.

Since tax depreciation deductions and credits are based on the historical cost of assets, their real values are reduced by inflation. Our estimates of effective tax rates were computed using inflation rates of 12.4 percent in 1980, 8.9 percent in 1981, 3.9 percent in 1982, and 3.8 percent in 1983. These rates are based on December-to-December changes in the Consumer Price Index. We assumed that the 1984 inflation rate would be six percent.

In addition to tax depreciation deductions, all types of farm equipment and structures except multipurpose structures are eligible for the investment tax credit. In 1980, the credit equalled ten percent of the purchase price for farm machinery, crop storage structures, and unitary livestock structures, and 6.7 percent for motor vehicles. Beginning in 1981, the credit for motor vehicles was reduced to six percent. The rate for other eligible types of farm machinery, equipment, and structures remained at ten percent.

For 1983 and beyond, the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) required that investors reduce all tax credits by two percent or reduce an asset's tax depreciation base by half of the amount of the tax credit claimed. Since the latter option generally yielded the lowest effective tax rates, we elected to reduce the tax depreciation base.

Beginning in 1982, investors could expense (immediately deduct) the cost of a limited amount of investment. However, no investment tax credit is permitted on expensed property. Since expensing generally yielded effective tax rates that exceeded those which could be obtained by claiming permissible tax depreciation deductions and credits, the expensing option was not utilized in this analysis.

All assets were assumed to have been purchased with full equity financing. The real after-tax rate of return on equity was assumed to be constant at six percent for all assets and all investors. To earn the same after-tax return, investors in the higher tax brackets would need to earn a larger before-tax return than those in the lower tax brackets. There is some evidence that larger farms earn higher before-tax returns on farm capital, presumably as a result of economies of scale (Hottel and Reinsel). Nevertheless, we found that variations in the assumed after-tax rate of return within the range of five to ten percent had only a slight impact on estimates of effective tax rates.

Results

Our estimates of average effective tax rates for 1980-1984 are presented in table 2. There are some wide differences in tax rates for the various types of farm capital. These differences may be affecting the farm capital mix (Jeremias, Hrubovcak and Durst). Since 1982, there has been a slight upward trend in the average tax rates for all farm capital, but tax rates for 1984 remain well below those of 1980.

Most of the effective tax rates in table 2 are less than the corresponding statutory tax rates shown in table 1. Some of the rates are actually negative. The negative tax rates indicate that the government is subsidizing many of the investments of low-income investors in farm capital.

The variation in effective tax rates over the 1980-1984 period can be attributed to the combined effects of three factors: changes in the rate of inflation, reductions in statutory tax rates, and modifications of the capital cost recovery system. Since the relative importance of these factors cannot be determined from the effective tax rates presented in table 2, the following sections isolate the impact of each of these factors on effective tax rate levels.

Capital Cost Recovery System

The capital cost recovery system specifies the rate and time period over which depreciation deductions may be claimed. Since depreciation deductions are limited to the historical cost of assets, inflation reduces the real values of the deductions that are claimed in the years following the year of purchase. These lower

Table 2. Effective Income Tax Rates for Farm Capital, 1980-1984

Asset type	1980	1981	1982	1983	1984
	Investor with $15,000 taxable income				
Motor vehicles[a]	.06	.08	−.13	−.14	−.09
Farm machinery[b]	−.04	−.01	−.17	−.17	−.13
Crop storage structures[c]	−.03	−.01	−.11	−.11	−.09
Unitary livestock structures[d]	.10	−.01	−.07	−.07	−.06
Multipurpose structures[e]	.21	.20	.15	.13	.14
All capital (average tax rate)[f]	.02	.03	−.10	−.10	−.07
	Investor with $60,000 taxable income				
Motor vehicles[a]	.59	.52	.30	.28	.33
Farm machinery[b]	.42	.39	.17	.17	.21
Crop storage structures[c]	.33	.31	.12	.12	.16
Unitary livestock structures[d]	.47	.23	.09	.08	.11
Multipurpose structures[e]	.53	.47	.38	.33	.34
All capital (average tax rate)[f]	.45	.35	.20	.19	.22

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[a] Autos and trucks.

[b] Tractors, combines, and all other farm machinery except motor vehicles.

[c] Silos, corn cribs, grain storage bins, and all other structures used principally for the bulk storage of crops.

[d] Milking parlors, poultry houses, unitary hog-raising facilities, and other structures used for the housing, raising, and feeding of a single type of livestock.

[e] Barns, machine sheds, garages, warehouses, dwellings for hired farm labor, structures used for the housing, raising, or feeding of more than one type of livestock, and all structures not classified elsewhere.

[f] Average effective tax rates were calculated by comparing the assumed six percent after-tax return with the weighted average of the before-tax rates of return on the five types of farm capital, with the weights proportional to the total market value of each type of capital.

real values produce higher effective tax rates. Thus, the timing of tax depreciation deductions is an important determinant of effective tax rates for capital income.

The capital cost recovery system used from 1971 to 1980 was the Asset Depreciaton Range System (ADR). This system was replaced by the Accelerated Capital Cost Recovery System (ACRS) in 1981. For most farm assets, the tax depreciation deductions under ACRS were initially not as generous as those permitted by ADR. However, ERTA provided that the ACRS deductions would be accelerated in 1985 and again in 1986. TEFRA cancelled the phase-in of the more generous deductions and reduced the value of investment tax credits.

Table 3 provides a comparison of average effective tax rates under ADR and ACRS. All of the tax rates in table 3 were computed using the 1980 inflation rate of 12.4 percent and the applicable statutory tax rates of 21 percent for low-income investors and 54 percent for high-income investors. These results suggest that ACRS, in its fully phased-in form, would have produced average effective tax rates below those existing under the ADR system. However, this difference would have been relatively small. This is consistent with Gravelle who found that the tax reductions for the agricultural sector were not as substantial as those for other sectors.

If the 1980 inflation rate and statutory tax rates had remained unchanged, the modification of ACRS by TEFRA would have increased average effective tax rates above those existing under ADR. Thus, despite the fact that incentives for investment in capital used in other sectors may be greater under the current system than under the ADR system, incentives for investment in depreciable farm capital are actually less than under the ADR system.

Table 3. Effective Tax Rates Under Alternative Capital Cost Recovery Systems, 1980[a]

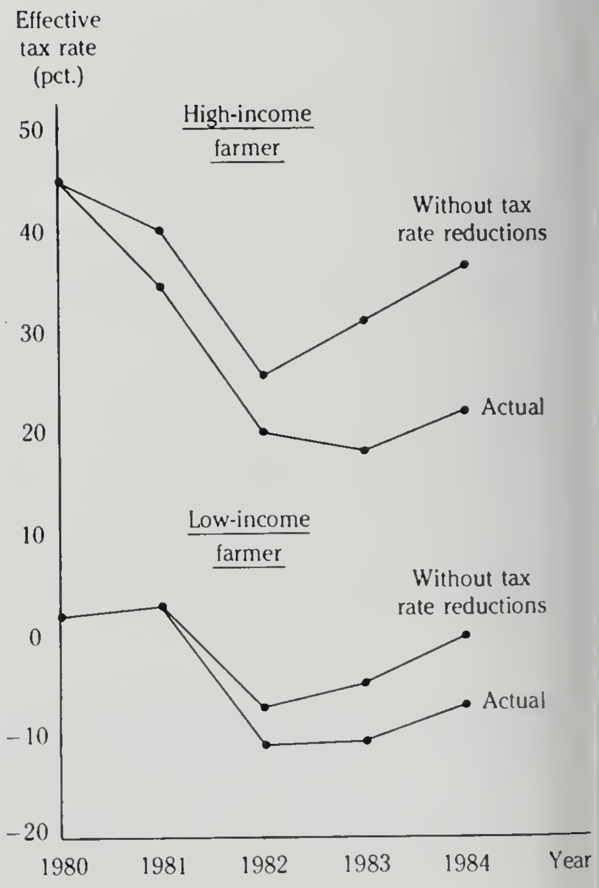
Taxable Income	ADR	ACRS		
		ERTA		TEFRA
		Initial	Full Phase-In	
Dollars		Percent		
15,000	2	4	0	6
60,000	45	46	42	48

[a]Figures shown are weighted averages of marginal effective income tax rates for the five types of farm capital shown in table 2. Weights are proportional to the values of the 1980 stocks of each type of capital. Estimates of effective tax rates were computed using the inflation and statutory tax rates for the 1980 tax year.

Statutory Tax Rate Reductions

Statutory tax rates and effective tax rates are equal only to the extent that taxable income equals the true income actually earned by the investor. Nevertheless, an increase or decrease in the statutory rate produces an increase or decrease in the effective rate. Figure 1 compares our estimates of effective tax rates for the period 1980-1984 with those that would have existed without the 23 percent reduction in statutory tax rates included in ERTA. The statutory tax rate reductions contributed to lower average effective tax rates for both low-income and high-income investors. This year (1984), the average tax rate for low-income investors is seven percentage points below what it would have been without the statutory tax rate reductions. The difference for high-

Figure 1. Comparison of Effective Tax Rates With and Without ERTA Tax Rate Reductions, 1980-1984

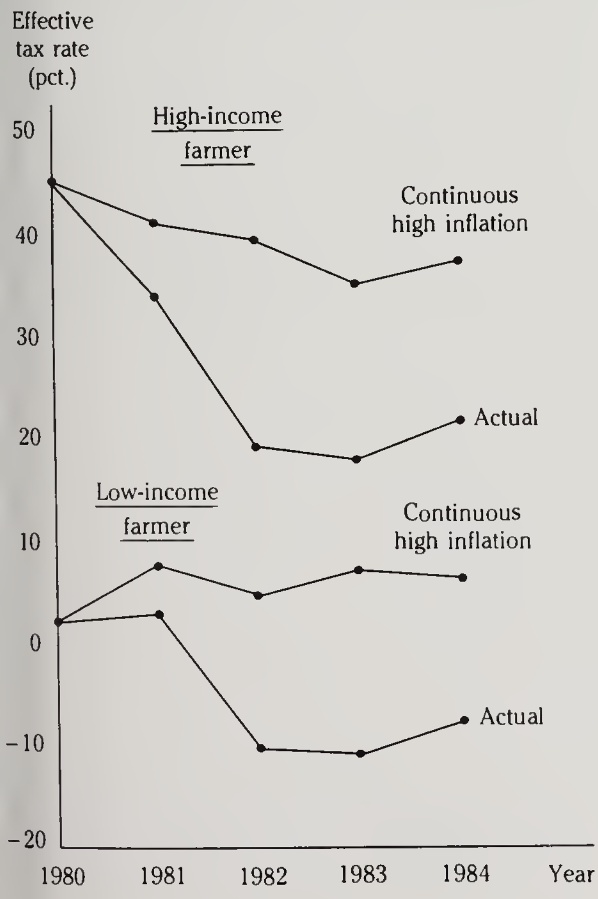


ncome investors is even more substantial. The verage tax rate for these investors is now 22 ercent. This is 17 percentage points below /hat it would have been without the tax rate eductions. One reason for this sharp drop in ne effective tax rate for high-income investors /as the reduction in the top statutory tax rate om 70 percent to 50 percent for 1981 and ater years.

nflation

nflation affects the tax burden on income from apital in two ways. First, it raises nominal ncomes causing a gradual increase in narginal statutory tax rates or tax brackets. 'his is often referred to as bracket creep. econd, it reduces the real values of the tax lepreciation deductions and credits which nust be claimed in future years. Figure 2 llustrates the relative importance of the eduction in the inflation rate. It compares the ctual average effective tax rates for the period 980-1984 with those that would have ccurred if inflation had continued at the 1980 ate of 12.4 percent. For high-income nvestors, the sharp drop in the rate of inflation reduced the average effective tax rate for 1984 from 38 percent to 22 percent. Although the actual percentage point reduction in effective tax rate for low-income investors was slightly lower, the relative impact was much greater. Without the reduction in inflation, the average effective tax rate in 1984 would have been seven percent rather than minus seven percent. The main factor contributing to this larger relative change for low-income investors is the differential impact of bracket creep on low-income and high-income investors. High-income investors with statutory tax rates near the top statutory rate of 50 percent are rarely affected by bracket creep. Thus, reductions in the rate of inflation and the indexing of the tax brackets and exemption levels scheduled to begin in 1985 will provide relatively greater benefits to lower-income investors.

igure 2. Impact of Inflation on Effective Tax Rates, 1980-1984



Conclusions

Our results suggest that average effective income tax rates for farm capital have declined since 1980, primarily as a result of the sharp reduction in the rate of inflation. The marginal tax rate reductions contained in ERTA, which were more than sufficient to offset the effects of bracket creep on statutory tax rate levels, also contributed to slightly lower effective tax rates. In contrast, the introduction of ACRS and the subsequent modifications of that system by TEFRA actually reduced incentives for investment in farm capital. Thus, despite the substantial amount of tax legislation that has been enacted since 1980, our findings indicate that in the absence of a decline in the rate of inflation, average effective tax rates for low-income investors would have increased from 1980 to 1984. In addition, reductions in average effective tax rates for high-income investors would have been relatively minor.

Beginning in 1985, the effects of inflation on effective tax rates will be somewhat lessened by the indexation of tax rate schedules and exemption amounts. While this will eliminate bracket creep, inflation will continue to affect the real values of nominal tax depreciation deductions and tax credits. Therefore, in the absence of major tax reform, inflation will continue to be the dominant factor affecting the effective income tax rates for farm capital. If the rate of inflation continues at its current pace or declines, average effective income tax rates will remain well below those of 1980. Under current law, double-digit inflation would have to occur to raise effective tax rates to their 1980 levels. Thus, barring a sharp rise in the rate of inflation or a delay in the indexation of tax brackets and exemption amounts, the existing capital cost recovery system will continue to provide substantial incentives for investment in depreciable farm capital.

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Banks and Farm Credit as Agricultural Lenders in Indiana

David A. Sherman and Lee F. Schrader

Abstract

Lender performances of commercial banks and the Farm Credit System (FCS) are compared using data from a survey completed during 1981. The survey was undertaken during a period of highly variable interest rates and changes in lending practices. FCS lenders were making loans at lower interest rates and with nominally more liberal credit terms than banks. FCS lenders, unlimited by state branching law, served larger areas than banks. Operating costs relative to loan volume were lower for the FCS lenders. Interest rate spreads were lower for banks at the time of the survey.

Key words: agricultural credit, cooperative credit interest rates, costs, lender performance.

The use of credit to finance agriculture has increased dramatically in the past decade. Total farm debt increased from $53 billion at the beginning of 1970 to $216 billion, January 1, 1983. As a result, the availability and terms of credit have become more important determinants of the structure, profitability, and financial stability of the agricultural economy. Commercial banks and the FCS are the most important institutional sources of credit to farmers. These lenders accounted for 49.6 percent of farm real estate debt and 56.2 percent of farm nonreal estate debt as of January 1, 1982. (Duncan, p.4)

Production Credit Associations (PCAs) and Federal Land Bank Associations (FLBAs), parts of the FCS, are cooperatives owned by and operated for the benefit of their borrower patrons. Commercial banks are usually operated for the benefit of their owners who, only incidentally, may also be patrons. Commercial banks have been subject to pervasive regulation including lending limits and regulation of interest rates paid on deposits. Indiana law limits branch banking to within the county in which the main bank is located, but does not restrict the size of the area served by units of the FCS. These differences might be expected to affect the performance of these institutions as lenders. For example, FCS lenders were expected to be oriented more to needs of their farmer-owners and, bank performance was expected to favor the private owners of the commercial banks.

The objective of our study was to compare the performance of banks to the performance of the Farm Credit System (PCAs and FLBAs) in Indiana with respect to farmer-borrowers and financial performance of the institutions themselves. We identify performance measures related to each of these groups and report the results of a survey of lending institutions conducted during the spring of 1981.

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A number of studies of bank performance have been based on the industrial organization paradigm. Heggestad described and analyzed more than 40 studies of bank performance and market structure. A Chicago Federal Reserve Bank study cited by Heggestad concluded that farm loan interest rates at banks were lower when a PCA was operating in the same market. Performance measures used in the studies reviewed include interest rates charged, number of banks, number of offices, profitability, and portfolio selection. None of the studies in his review compared the performance of banks and the FCS.

Webb investigated the allegation that advantages in regulation available only to PCAs have resulted in diminished commercial bank performance. He concluded that—based on an analysis of the affect of major regulatory and insitutional differences on bank profitability and market share—the differences in regulation had not been economically harmful to commercial banks as a whole.

Lender Performance

Performance dimensions affecting farmers as borrowers include interest rates, loan covenants, loan size, and recent changes in loan terms. Factors affecting the institution (its owners) were identified as return on assets, return on equity, effective tax rate, expenses relative to loan volume, interest spread, and loans outstanding relative to total assets. The financial health of farm borrowers, related to lender performance, is important to both borrowers and institution owners.

The share of farm real estate lending by FLBAs increased dramatically during the 1970s at the expense of all lender groups except Farmers Home Administration (FmHA). PCAs' share of nonreal estate lending increased slightly during the same period while banks lost share, primarily to FmHA. These data indicate a major differential in attractiveness of lenders to farmer-borrowers.

Procedure

Data were collected directly from financial institutions. Separate but roughly parallel survey forms were used for banks, PCAs, and FLBAs. The bank questionnaire was administered in personal interviews with a bank executive or an agricultural loan officer. The FCS organizations were interviewed by mail because we had reason to expect complete cooperation from these organizations.

Annual reports for calendar year 1980 were requested for all survey respondents. Information in these somewhat variable documents was supplemented by Bank Call and Income reports which were obtained from regulatory agencies. Detailed financial statements for Indiana PCAs were obtained from the Federal Intermediate Credit Bank of Louisville and for the FLBAs either directly from the institution or from the Federal Land Bank of Louisville.

All Indiana PCAs (10) and FLBAs (23), cooperated in the survey. Approximately 230 of the 411 commerical banks in the state had at least a $2.5 million loan commitment to agriculture or had 25 percent or more of their loan portfolio in farm loans (our definition of an agricultural bank). All banks in each of the ten PCA areas were listed in random order. Banks, contacted in order from the random list, were selected for inclusion in the sample if the bank qualified as an agricultural bank and if it agreed to participate in the survey. The process was continued in each area until 20 percent of the banks in that area were included. Thus, the 80 bank sample which was selected included about 20 percent of all banks distributed geographically in proportion to all banks but including only those classed as agricultural.

The data for FCS lenders represented the population. Therefore, statistical tests were structured to test for differences between banks and the known population values for the FCS lenders.

Results

A summary comparison of banks and FCS lenders with respect to interest rates, loan terms, maximum loan as a percent of collateral, and average loan size is presented as table 1. Interest rates charged for long-, intermediate- and short-term loans as of March 31, 1981, were collected. Direct comparison was possible only for variable rate loans because PCAs and FLBAs wrote no fixed rate loans. Banks were in a period of adjusting their philosophy of loan pricing during this period of high and volatile interest rates. Many had not converted to variable interest rates nd were unwilling to make any long- or ntermediate-term loan commitments.

Rates of interest charged by FCS lenders adjusted to include mandatory stock purchase) vere 2.8 to 4.8 percentage points lower than omparable bank rates in March 1981. This ather substantial difference reflects the use of verage cost of funds as a rate base for PCAs nd FLBAs rather than current cost used by banks in a period of rising interest rates. The same procedure would produce lower rates for banks in a period of declining interest rates. Bank rates for fixed rate loans were slightly lower than for variable rate loans at the time of inquiry.

able 1. Agricultural Loan Characteristics by Type of Loan and Type of Lender

oan Characteristics	Banks	PCA's	FLBA's
nterest rates charged		*percent*	
ong-term			
fixed rate	15.72		
variable rate*	16.48		11.68[a]
ntermediate-term			
fixed rate	17.44		
variable rate*	17.77	14.95[a]	
hort-term			
fixed rate	17.37		
variable rate*	17.75	14.95[a]	
verage loan maturity		*years*	
ong-term			
fixed rate	14.03		
variable rate*	12.58		28
ntermediate-term			
fixed rate	3.00		
variable rate	4.14	4.07	
hort-term			
fixed rate	.54		
variable rate*	.73	1.00	
oan limit as percent of collateral			
ong-term			
fixed rate	76.05		
variable rate*	77.67		84.13
ntermediate-term			
fixed rate	75.52		
variable rate (NT)	74.17	80-100	
hort-term			
fixed rate	75.33		
variable rate (NT)	74.33	80-100	
*lumber of farm borrowers**			
	218	2094	905
verage loan size (NT)			
$54,316	$43,457	$68,050	NT

*Difference between banks and FCS lender significant at .05 level.

T= Not tested

[a]Adjusted for mandatory stock requirement

The average maturity of long-term (real estate) loans by FLBAs was 28 years, more than twice that for banks. Some of the banks were reluctant to write long-term loans, but, instead, used guaranteed renewable short-term loans to finance real estate. Thus, the effective difference may be less than it appears to be. The length of variable rate intermediate-term loans at banks which did make these loans did not differ significantly from those at PCAs. Banks made short-term loans for the specific period needed by the borrower, whereas PCAs made loans for one year as a standard practice. Lines of credit were not treated separately in the survey.

The mean maximum agricultural loan by FLBAs was 84 percent of collateral, significantly higher than that of banks. Respondents found it difficult to characterize short-term loan maxima as a percent of collateral because many granted unsecured loans or based their decision on the applicant and the project. The FCS lenders did indicate a higher maximum loan relative to collateral for all loan types than did bankers who provided maximum loan data.

Areas served by PCAs and FLBAs were larger than banks which were limited by branching laws. Thus the average number of farm borrowers per unit and the average number of agricultural loans outstanding for the FCS lenders far exceeded those for banks. The average individual loans were largest at FLBAs ($68,050) followed by banks at $54,316 and PCAs at $43,457. The loan size differences reflect different mixes of loan types and may not indicate any difference in size for similar loan types. Banks were unable to provide data by type of loan.

Lenders were asked if their use of 18 loan terms other than interest had changed from spring 1980 to summer 1981 (table 2). Significant differences in the pattern of changes in or use of loan terms between banks and FCS lenders were evident in most cases. Banks indicated somewhat more changes as all three lenders moved toward greater loan security

Table 2. Percent of Lenders Increasing and Decreasing* the Use of Selected Loan Terms from Spring 1980 to Summer 1981 by Type of Lender.

Loan terms	Banks		PCAs		FLBAs		
	Inc	Dec	Inc	Dec	Inc	Dec	
Amount of collateral required	53.7	0	20.0	0	28.6	0	**
Use of variable rate loans	61.2	0	20.0	0	42.9	0	**
Length of loan	22.5	46.2	20.0	20.0	0	9.5	**
Line of credit financing	55.7	0	20.0	0	31.6	0	**
Partially amortized loans	30.0	5.0	10.0	0	20.0	0	**
Short term automatic renewal	32.9	6.3	20.0	0	19.0	0	**
Prohibit equipment purchase	21.2	1.2	50.0	0	9.5	0	**
Prohibit dividend payment	2.5	0	0	0	4.8	0	**
Require management input	33.7	0	55.6	0	42.9	0	**
Require more farmer equity	37.5	0	40.0	0	47.6	0	
Limit amount for family living	13.7	0	10.0	0	14.3	0	
Subordinate other debts	21.2	1.2	22.2	0	14.3	0	**
Require cash budgets	61.2	0	90.0	0	57.1	0	**
Require periodic financial statements	37.5	0	80.0	0	38.1	0	**
Require farmer to become current with accounts payable	30.0	0	30.0	0	33.3	0	**
Require second mortgage as security	68.8	0	30.0	0	38.1	0	**
Require personal guarantee	47.5	1.2	30.0	0	20.0	0	**
Require all banking or financing at same institution	47.0	0	10.0	10.0	10.0	0	**

*Remaining respondents reported no change or did not use the loan term.

**Banks significantly different from one or both PCAs and FLBAs at the .05 level using Chi-square test.

and attention to or control over the borrower's business. The largest number of banks indicated increased collateral requirement, variable rate loans, line of credit financing, required cash budgets, and use of second mortgages. The FCS lenders had already switched to variable rate loans. Their indication of change toward variable rates could reflect only the maturation of older loans. The pattern of changes in FCS lender terms was primarily toward greater knowledge and monitoring of the borrower's business.

Questions regarding reasons for loan denials revealed that loan limits and lack of funds limited bank lending but did not limit FCS lenders. Insufficient collateral was cited by banks substantially more often than by FCS lenders. Excessive operating risk was cited most often by all three types of lenders but appeared to be a much more important reason for loan denials by FCS lenders than by banks.

Financial performance and costs of operation were calculated for selected measures (table 3). Some measures could not be calculated for individual FLBAs because FLBAs are organized as agents or branches of the Federal Land Bank of Louisville. In those cases data represent the entire Louisville district. Return on assets was found to be highest for PCAs, with banks reporting the highest return on equity. This reflects the PCAs relatively conservative balance sheet. The FLBs and PCAs, having no reserve requirement, are able to maintain higher loan to total assets ratios than banks, averaging 88.5 percent and 97.2 percent respectively, contrasted with 55.1 percent for banks. Costs measured were generally lower for the FCS lenders except for FLBA office space. The measures selected do not take into account the additional services provided by banks nor the difference in sources of loanable funds. Interest expense as a percent of loans outstanding was lowest for the FLB (8.018) and highest for PCAs (10.74) at the time of the survey. The interest spread, calculated as interest income less interest expense as a percent of assets, was largest for PCAs (1.79) and lowest for the FLB (0.742). The lower than expected interest spread for banks (.964) is due partly to the use of bank assets to generate income other than interest. It also reflects the relatively low loan to assets ratio of banks and a substantial amount in lower fixed interest rate loans outstanding in a period of high interest rates. Thus, the result reflects the differential impact of the financial environment which may outweigh any institutional difference at the time of the survey.

A higher effective income tax rate for PCAs relative to banks reflects the fact that banks can take advantage of certain tax free investments which are not used by PCAs. The Federal Land Banks are not subject to federal income tax.

Respondents were asked about trends in overall demand for farm loans they perceived during 1980. All but five of the FLBAs found that the demand for long-term loans was increasing whereas only a third of the banks indicated such an increase. About a third of the banks and 40 percent of the PCAs perceived an increase in demand for intermediate-term loans whereas 60 percent of the banks and 90 percent of the PCAs saw an increase in demand for short-term loans. When asked about change in their own agricultural loan volume, more than half of the banks, 70 percent of the PCAs, and all but one FLBA indicated an increase in volume.

Table 3. Performance of Banks, PCAs, and FLBAs on Selected Financial and Operation Measures

Measure	Banks	PCAs	FLBAs
	Percent		
Net income, percent of assets	1.041	1.300	0.750[a]
Net income, percent of equity	12.408	8.205	8.413[a]
Loans, percent of assets	55.092	88.520	97.220[a]
Salaries & benefits, percent of loans	2.435	.840	0.170
Cost of space, percent of loans	0.166	0.073	0.222
Interest expense, percent of loans	10.224	10.740	8.018[a]
Interest spread, percent of assets	0.964	1.790	.742[a]
Effective federal income tax rate	14.797	42.820	NA

[a] Calculated for Federal Land Bank of Louisville.

Table 4. Percent of Farm Loans in Various Conditions in 1980 by Lender Type.

Status of loan	Banks	PCAs	FLBAs
	Percent		
Easily paid debt	63.2	44.0	76.3
Difficulty paying debt	26.1	31.9	17.6
Did not pay, still farming	9.2	22.5	4.2
Did not pay, quit farming	1.5	1.6	1.9

The financial condition of borrowers in 1980 (reported by lenders) varied with type of lender (table 4). The percentage of borrowers who did not repay debt and left farming was larger for the FCS lenders but the differences were not statistically significant. The proportion not paying debt but still farming was highest for PCAs and lowest for FLBAs. The data indicate that PCA borrowers were in poorer financial condition than bank and FLBA borrowers. This may reflect the concentration by the PCAs on operating credit in a year of poor crop yields.

Conclusions

To interpret the results of this study one must recognize that the survey covers a period of rapid change in interest rates and regulation of banks. Lenders and borrowers alike were adjusting to change. The data represent the situation in 1980 and early 1981, which cannot be characterized as an equilbrium state of the relationship among lenders.

FCS lenders were making loans at lower interest rates and with more liberal terms than banks. FCS lenders were also generally willing to make loans for a larger percentage of collateral than banks. Larger numbers of borrowers were served by individual FCS associations than by banks, which are limited by Indiana law to within-county branching.

Operating costs relative to loan volume for the FCS lenders were lower than for banks. Some or all of that difference may be due to differences in noncredit services offered or to costs of serving depositors for banks. Interest spreads were lowest for FLBAs and effective income tax rates were found to be higher for PCAs than for banks. No consistent differences in financial health of borrowers were identified among the lender types.

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Equity Levels Necessary for Successful Entry Into Dairy Production

William Grisley and Matthew C. Grady

Abstract

The minimum level of equity necessary to successfully enter dairy production on a family farm with 1.5 person units of labor is investigated under different types of business organizations, milk production levels, sources of financing, and rental rates on cropland and milking facilities. Results indicate that under the most favorable circumstances an owner-operator would need $71,579, a whole-farm renter would need $20,824, and a milking-facility renter would need $37,604 in starting equity to be financially solvent at the end of a five-year period. The whole-farm and milking-facility rental business organizations offer the most viable opportunities for success.

Key words: dairy production, successful entry, beginning equity, financial solvency.

The structure of the dairy industry in the Northeast is characterized by the family owner-operated production unit. Family farms supply most of their own labor requirements, produce a majority of their feed inputs, and raise their own replacement heifers. The future survivability of the family-operated dairy farm depends upon the continued successful entry by young farm families and its comparative advantage in feed and milk production (Malone). Difficulty of entry is directly related to the initial level of equity funds held by beginning farmers, their access to debt funds at reasonable rates and terms, and the general profitability of milk production. The accumulation of a sizable amount of equity funds is of critical importance. Few lending institutions are willing to lend funds to a beginning farmer who has little or no equity because of the risk involved in meeting large debt repayments.

Beginning farmers have typically gained access to equity funds through inheritance, marriage, or accumulation from employment earnings. Regardless of the amount of equity funds a prospective entrant has available, questions regarding the future profitability of milk production must be considered when investigating the financial feasibility of entry and progress over time. The persistent and increasing excess supply of dairy products will have important implications regarding the milk price support program and dairy farm profitability in the future.

The purpose of this study is to investigate the minimum level of equity necessary for a young farm family to successfully enter dairy production and be financially solvent at the end of a five-year period. To make the analysis as broad as possible, three different types of

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family farm organizations common in Pennsylvania and the Northeast are examined. These are the owner-operated, whole-farm rental, and building-facility rental business organizations. Each is analyzed under various assumptions on milk production per cow, debt financing terms, and farm rental rates. The farm operations are simulated over a five-year period to determine the minimum starting level of equity funds necessary to achieve financial solvency. A farm alternative is deemed to be financially solvent if it is able to pay all cash expenses, debt payments, and income and social security taxes by the end of the fifth year and withdraw $12,000 annually for family living expenses. The dollar value of starting equity necessary to meet the financial solvency criterion was used as the indicator of ease of entry into dairy production.

This paper is organized into four sections. Previous efforts that examined issues of entry are reviewed in section one. The model assumptions and data used are presented in section two. The simulated results are summarized in section three, and the implications for entry are discussed in section four.

Literature Review

Over the past decade there has been a renewed concern about the farm entry problem. Most of the published studies examined issues relating to the difficulty of entry at various points in time, financing schemes for the low-equity farmer, land shortages, and the importance of the father-son relationship. Investigating agricultural production in two counties in New York and one county in Minnesota, Lowenberg-DeBoer found little difference in the degree of difficulty for successful entry for the years 1910, 1930, 1950, and 1978. His conclusions for young tenants, however, indicated that problems associated with equity capital accumulation have increased over time and without new entrants the existence of the family farm could be severely threatened. These findings agreed with those of LaDue who found that, in general, it was at least as difficult to enter agricultural production in 1979 as it was during the 1950s for entrants using institutional type financing and leasing arrangements.

Successful entry strategies followed by beginning farmers include the "agricultural ladder" process, the father-son relationship, and "marrying it." In the "agricultural ladder" process the entrant starts as a farm worker and accumulates enough capital to become a renter, then a partial owner, and finally a full owner (Boehlje, 1973). Today, few argue that the "agricultural ladder" is a viable strategy because the amount of capital necessary to get started on an economically viable unit is beyond the capacity of most potential young entrants. The father-son relationship was found by Brake to be a viable alternative for new entrants. Family assistance was also found to be important for success by Boehlje and Thomas, Epperson and Bell, and Reiss. Creative financing schemes were investigated by Baker McClateky, Boehlje (1981), and Penson and Duncan. However, Kanel concluded as early as 1960 that attempts to assist potential entrants through the use of increased credit availability would only increase the demand for farm opportunities and have no affect on the supply.

The amount of beginning equity and the level of debt-to-assets for successful entry has been investigated by several writers. Herr and Obrecht found a Midwestern farmer could successfully enter with only one-quarter of the average investment of an established farm if land and capital equipment were rented rather than debt financed. Investigating low equity positions and debt terms, Harris and Saupe found that while low equity was not a problem itself, high levels of short-term debt could result in severe cash flow problems. Hanson and Thompson found that small and medium size dairy farms could be successful with debt-to-asset ratios of 0.348 and 0.414, respectively.

Simulation Model Assumptions

A firm level simulation model originally developed by Hutton and Hinman was modified and used to analyze the different farm alternatives over a five-year period. The five-year period was selected because it allows for debt refinancing in the early years of the operation if cash flow problems emerge. Lending institutions frequently permit refinancing during the first few years, but may be reluctant to continue a refinancing program if the farm is not successful after a period of five years.

The owner-operator (O-O), whole-farm renter F-R), and building-facility renter (B-R) farm ypes were analyzed by level of milk roduction, source of financing, and rental ate. A total of 42 distinct farm alternatives were analyzed. The O-O farm is a fully owned roduction unit that purchases all assets with debt or equity funds and produces feed, eplacement heifers, and milk. The F-R farm is dentical to the O-O farm with the exception hat all real estate is rented on a cash basis. The B-R farm cash rents the milking facility and purchases all feeds. The O-O and F-R farms were assumed to milk 40 cows and hold 29 heifers of various ages in each of the five years. This relation of heifers-to-cows is similar to the average on dairy farms in Pennsylvania. The B-R farm was assumed to milk 50 cows and have 36 replacement heifers of various ages. A larger livestock inventory was assumed for this farm because all feeds are purchased, thus freeing labor for milking additional cows. Equilibrium in cow numbers on all farms was maintained over the five-year period through the use of 28 percent culling rate for the milking herd, a 13.55 percent culling rate for heifers, a calving rate of 90 percent, and a death-loss rate of 2 percent for cows and 2.5 percent for heifers. All bull calves were sold within three days of birth.

The O-O and F-R farms were assumed to have 76 acres of forage crops, 42 acres of corn grain, and a stanchion barn with adequate heifer and feed storage space. The B-R farm has a stanchion barn and feed storage facilities to store purchased feeds. Crop production and land management ability on the O-O and F-R farms were assumed to be average or below. Actual crop yields and prices used were taken from the 1981 Pennsylvania Farmers Association (PFA) records for farms of similar size.[1] Corn grain yields were 74.27 bushels per acre, alfalfa yields were 2 tons per acre, and corn silage yields were 14.02 tons per acre. The O-O and F-R farms were assumed to produce their corn silage requirements, but were allowed to produce corn grain and hay in excess of the herd's requirements. All marketed feeds over the five-year period were sold at 1981 average farm-gate prices with alfalfa at $99 per ton and corn grain at $2.60 per bushel. The B-R farm purchased alfalfa and corn grain at these prices and purchased corn silage at $22.60 per ton. Pasture was not included as all livestock were assumed to be confined to the barn and a small exercise lot. Feeding requirements for concentrates, hay, and corn silage were taken from *The Penn State Farm Management Handbook.*

The machinery and equipment package used in crop production was assumed to be composed of second-hand items and adequate to handle the acreage cropped over the five-year period without major repairs or replacement. A machinery maintenance expense of $3,396 per year was included in the operating expenses for the O-O and F-R farms. No crop machinery and equipment were included in the B-R farm analysis. Each of the farm types employed 1.5 person equivalents of labor, with the operator contributing one unit, the spouse contributing 0.25 units, and 0.25 units of hired labor for periods of peak demand and at times of operator illness or absence from the farm. Even though the B-R farm does not produce feed, hired labor will be required for feed storing. Hired labor was budgeted at $4 per hour. When applicable, real estate taxes were levied at a rate of 1.5 percent of the value of land and buildings. Insurance expenses on buildings were estimated using a rate of $0.012 per dollar of inventory and insurance on machinery and livestock was expensed at $0.0066 per dollar of inventory. Family living withdrawals were held constant at $12,000 per year for all farms over the five-year period. In the base year, 1981, milk was sold at $13.50 per hundred pounds, cull heifers were sold at $600 each, culls cows were sold at $41.08 per hundredweight, and bull calves were sold at $86.40 per hundredweight. These values are in agreement with 1981 PFA record figures.

The farm types were analyzed using three levels of milk production per cow (13,000, 15,000, and 17,000 pounds), two sources of debt financing—Farmers Home Administration (FmHA) and the Farm Credit System (FCS)—and three rental rates for cropland and buildings. Three levels of milk production were selected to represent farms of average to excellent dairy management and cow technology. As a comparison, Pennsylvania and PFA averages for 1981 were 12,434 and 13,594 pounds per cow. Under FmHA financing, real estate mortgage terms were 35 years at a 10.75 percent annual rate of interest. Farm Credit System real estate loans were for 35 years at a 15.5 percent rate of interest. Intermediate-term debt for financing machinery and equipment and livestock was set up on a seven-year repayment schedule at an interest rate of 10.25 percent for FmHA funds and 15 percent for FCS funds. Operating debt maturity was set at two years with interest rates of 10.25 percent for FmHA and 15 percent for FCS.[2] The debt structure in the base year for the O-O farm was 60 percent in real estate and 40 percent for intermediate and operating debt. For the latter, 90 percent was assumed to be intermediate term and 10 percent operating. The O-O farm will thus have debt in all three categories. For the F-R and B-R farms, all debt was intermediate and operating, with 90 percent in the former and ten percent in the latter. These assumptions on debt structure approximate that of farms with herd-sizes of 40 to 49 cows in the PFA records and are in line with FCS lending policies in 1981. If a negative cash flow emerges during the five-year period all necessary borrowing to cover the deficit occurs as an operating loan. Thus, no refinancing on long- and intermediate-term debt was allowed. All debt repayment schedules were assumed to have equal annual combined principal and interest payments.

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[1] The Pennsylvania Farmers Association collects records for more than 2,000 Pennsylvania dairy farmers.

Three rental rate levels were used for the F-R and B-R farms to determine the effect that different rates have on financial solvency. For the F-R farm the annual rental rates for land (118 acres) and facilities were $150, $200, and $248 per cow. The annual rates on facilities for the B-R farm were $75, $100, and $125 per cow. It was assumed that the necessary equipment for feeding and milking was included in the facilities rental rate. Actual rental rates in Pennsylvania are unavailable, but it is expected they would fall within the ranges used here. In a 1981 report Dum found that the annual ownership cost of a new facility for a 50-cow herd was $188 per cow and an equitable lease payment would range from $150 to $250 per cow. Rental rates for used facilities would be lower. Using 1981 PFA data for herds with 40 to 50 cows, the amortized value of facilities ranged from $90 to $100 per cow assuming a maturity of 35 years and an interest rate of 10.75 percent. The range of rental rates assumed for the B-R farm are in line with these values. The average 1981 rental rates for cropland in Pennsylvania was $37.50 per acre (Pennsylvania Crop Reporting Service.) Using rental rates of $25, $35, and $45 per acre for 118 acres results in land rates per cow of $74, $103, and $133, respectively. Combined land and facility rental rates of $150, $200, and $248 per cow are thus in agreement with actual land rental rates and the calculated amortized value of building facilities in 1981. However, land rental rates of $100 or more per acre are not uncommon in the more productive southeast region of the state.

Federal income taxes were included assuming the couple was filing jointly. The operator and spouse were allowed the standard $1,000 deduction, plus a general standard deduction of $3,400. The farms were assumed to earn no off-farm income.

The starting level of investment for the three O-O farm alternatives was $215,021 for the 13,000-pound producer, $216,221 for the 15,000-pound producer, and $230,421 for the 17,000-pound producer. For the F-R farms, starting levels of investment were $98,568, $99,768, and $113,968 for the 13,000-, 15,000-, and 17,000-pound producers, respectively. The B-R farm started with investments of $78,500, $80,000, and $97,750 for the 13,000-, 15,000-, and 17,000-pound producers, respectively. Differences in investment levels within each farm business type were due solely to the higher capital costs of the more productive cows.

The farm alternatives were simulated over a five-year period under specific input and output price trends. Milk prices were decreased to $12.50 in 1982 and to $11.58 in 1983 and increased to $12.32 in 1984 and to $13.13 in 1985. The market prices received for calves, heifers, cull cows, hay, and corn grain were assumed to remain constant at 1981 levels. Cash operating costs were taken from the 1981 PFA records for farms of similar size (see Grady for a detailed description). Operating costs on the O-O and F-R farms in the first year of operation were $45,508, $50,171, and $54,300 at the 13,000-, 15,000-, and

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[2] A two-year repayment schedule was used to conform to the definition of operating debt as used by the Pennsylvania Farmers Association. For livestock, a repayment schedule of seven years is not uncommon if the loan is part of a comprehensive loan package. A dairy livestock loan by itself will usually have a maturity of five years.

17,000-pound production levels, respectively. For the B-R farm these costs were $70,001, $74,313, and $75,326 respectively. All expenses, with the exception of interest, insurance, and building and machinery repairs and maintenance, were increased at a rate of 4.9 percent per year for all farms. Interest expenses were charged on the basis of the principal outstanding at the beginning of each period. When additional operating credit was required, the interest charged was equal to the base rate assumed in 1981. Rental rates for the F-R and B-R farms were fixed over the five-year period. If surplus cash was generated it was not invested off the farm to earn interest income. In most cases the surplus cash flow was small in any one year.

Results

The results of the 42 different farm alternatives simulated are summarized in table 1. Each alternative reported is optimal in the sense that the beginning level of equity investment to achieve financial solvency at the end of the fifth year was minimized. A lower level of equity, and therefore more debt, would result in an infeasible solution and a higher level of equity would result in a positive net cash flow after taxes and family withdrawals. As expected, the level of equity necessary to achieve financial solvency by the end of the five-year period differed by farm business type and the assumptions on milk production, source of financing, and rental rates. The O-O farm that was able to start with the lowest percentage of equity, and hence the highest percentage of debt, was that producing at 17,000 pounds of milk per cow and using FmHA financing. Beginning equity was $71,579, which was 31.1 percent of the $230,421 initial investment. Given the assumptions made on production, resource utilization, and prices, this farm could start with a debt load of $3,971 per cow. The necessary levels of starting equity for the farms producing at $13,000 and 15,000 pounds of milk were larger at $116,964 and $87,806, even though the initial levels of investment were less. The farm producing at 13,000 pounds could only handle a debt load of $2,451 per cow. The farms producing at 15,000 and 17,000 pounds of milk per cow showed a gain in equity after depreciation over the five-year period. The 17,000-pound average farm showed the largest absolute increase at $19,073. This farm was able to increase its equity more than the lower producing farms because it had a higher revenue and was not forced to borrow short-term debt to meet long- and intermediate-term debt repayments.

Under FCS financing the necessary level of beginning equity increased due to the larger annual interest payments. Additional starting equity investments of $13,845, $20,846, and $27,136 were needed for the farms producing at 13,000, 15,000, and 17,000 pounds, respectively. Because of the high levels of refinancing with operating debt, the farm producing at 13,000 pounds of milk showed a decrease in equity over the five-year period. These results demonstrate that even at high levels of milk production and using cheaper FmHA financing, a beginning owner-operated farm would need a sizable amount of initial equity to enter production and be financially solvent at the end of a five-year period.

It was noted earlier that depreciation was not being replaced over the five-year period. However, if a farm can meet the debt payments and maintain or increase the starting equity position, it would be in a favorable position to secure new loans to replace depreciated items. In the above situations, the farm producing at 13,000 pounds of milk under both sources of financing showed a decrease in equity. As a result, its potential borrowing capacity could be reduced and make further debt financing of intermediate-term capital items more difficult.

The necessary levels of starting equity, but not necessarily the percent equity, were less for all the alternatives simulated for the F-R farm and all but four of the B-R farm alternatives as compared to the O-O farm alternatives. This was due primarily to the smaller initial levels of investment necessary to enter production. The initial investments for the F-R and B-R farms ranged from 46 to 49 and 37 to 42 percent of those required by the O-O farms depending on the level of milk production. As expected, the lowest level of initial equity required for both farm types was at the highest production level, with FmHA financing and the lowest rental rate. For the F-R farms, the farm producing at 17,000 pounds of milk, with FmHA financing and paying a $150 per cow rental rate on buildings and land, could successfully enter production and be financially solvent at the end of the five-year period with

Table 1. Simulated Results for Financial Solvency

Farm[a] Type	Cwt. Milk Per Cow	Source[b] Financing	Rental Rate Per Cow	Percent[c] Starting Equity	Beginning Equity	Ending[d] Equity
0-0	130	FmHA		54.4	$116,964	115,842
0-0	150	FmHA		40.6	87,806	93,780
0-0	170	FmHA		31.1	71,579	90,642
0-0	130	FCS		60.8	130,809	119,977
0-0	150	FCS		50.3	108,652	108,920
0-0	170	FCS		42.8	98,715	107,163
F-R	130	FmHA	$150	46.2	45,547	56,171
F-R	150	FmHA	150	26.5	26,406	50,744
F-R	170	FmHA	150	18.3	20,824	62,771
F-R	130	FCS	150	50.9	50,187	58,728
F-R	150	FCS	150	33.0	32,925	52,298
F-R	170	FCS	150	25.5	29,069	59,188
F-R	130	FmHA	200	54.7	53,932	58,725
F-R	150	FmHA	200	33.6	33,514	52,893
F-R	170	FmHA	200	24.3	27,710	60,870
F-R	130	FCS	200	57.9	57,102	59,565
F-R	150	FCS	200	39.7	39,601	54,466
F-R	170	FCS	200	31.3	35,691	62,895
F-R	130	FmHA	248	63.3	62,386	61,198
F-R	150	FmHA	248	40.0	39,936	55,105
F-R	170	FmHA	248	30.3	34,586	63,008
F-R	130	FCS	248	66.2	65,286	61,944
F-R	150	FCS	248	46.0	45,931	56,529
F-R	170	FCS	248	36.8	41,908	64,840
B-R	130	FmHA	75	88.9	69,788	72,665
B-R	150	FmHA	75	54.7	43,773	66,365
B-R	170	FmHA	75	38.5	37,604	81,758
B-R	130	FCS	75	90.1	70,693	73,483
B-R	150	FCS	75	58.5	46,781	68,408
B-R	170	FCS	75	43.7	42,668	80,117
B-R	130	FmHA	100	94.8	74,401	71,649
B-R	150	FmHA	100	60.0	48,033	67,454
B-R	170	FmHA	100	43.2	42,271	82,876
B-R	130	FCS	100	95.5	74,924	76,562
B-R	150	FCS	100	63.7	50,944	69,187
B-R	170	FCS	100	45.6	44,539	82,538
B-R	130	FmHA	125	e	e	e
B-R	150	FmHA	125	65.7	52,567	67,629
B-R	170	FmHA	125	47.4	46,348	83,033
B-R	130	FCS	125	e	e	e
B-R	150	FCS	125	68.6	54,897	74,621
B-R	170	FCS	125	51.6	50,426	81,283

[a] 0-0 = owner operator F-R = whole farm renter; B-R = building renter

[b] FmHA is the Farmer Home Administration and FCS is the Farm Credit System.

[c] Percent of the total investment in equity necessary to be financially solvent at the end of the five-year period.

[d] Dollars of equity at end of the five-year period.

[e] An infeasible solution with 100 percent equity financing.

$20,814 of beginning equity. This was 18.3 percent of the starting investment of $113,968. The debt load per cow was $2,329. Over the ive-year period this farm increased its equity by $41,947. At milk production levels of 3,000 and 15,000 pounds per cow the farms could not carry as much debt, and the necessary levels of starting equity were thus greater at $45,547 and $26,406, respectively. Because of the financing of intermediate-term debt with operating debt, these farms showed smaller gains in equity. Using FCS financing ncreased the necessary starting levels of equity by approximately $5,000 to $8,000 across the three levels of milk production.

ncreasing the rental rate by increments of $50 per cow to $200 and $248 resulted in increases n starting equity of approximately $6,000 to $14,000. At these rental rates, the higher priced FCS financing resulted in a larger absolute change in the starting level of equity on the higher producing farms as compared to the results found under FmHA financing. With a rental rate of $248 per cow, the farm producing at 13,000 pounds of milk was unable to show a gain in equity by the end of the fifth year under either source of financing. This was due to the frequent refinancing of intermediate-term debt with operating debt.

The starting levels of investment for the B-R farm alternatives were less than those for the F-R farm alternatives at all milk production levels. The B-R farms had no investment in crop production machinery and equipment, but did have a larger investment in the milking herd and replacement heifers due to the larger herd size. At the 17,000-pound herd average, with FmHA financing and a rental rate of $75 per cow, the necessary level of beginning equity was $37,604. This was 38.5 percent of the starting investment of $97,750. This farm could carry a starting debt load of $1,504 per cow. The gain in equity over the five-year period was $44,154. At the 13,000- and 15,000-pound production levels the necessary starting levels of equity were $69,788 and $43,773, or 89 and 55 percent of the starting levels of investment. In terms of debt per cow, the debt loads were $218 and $906. Using higher priced FCS financing had a larger impact on the beginning level of equity on the higher producing farms. Increasing the building rental rate by increments of $25 dollars per cow had a larger impact on the beginning equity of the lower producing farms. Notably, at a rental rate of $125 per cow the 13,000-pound producer could not enter production and be financially solvent by the end of the fifth year with 100 percent equity financing.

Implications and Conclusion

These results clearly demonstrate that significant financial barriers impede successful entry into dairy production in Pennsylvania. While new entrants may strongly prefer to be owner-operators, they will find that the necessary level of starting equity is prohibitively large even at high levels of milk production and with the assistance of cheaper FmHA financing. Few beginning young farm families have accumulated savings of $70,000 to $100,000 to invest in a dairy farm. For the low-equity beginning farmer entering production as a whole-farm renter or a building renter and feed purchaser offers more promise for financial success. The results show that a whole-farm renter with a starting equity base of $20,824 could enter production and be financially solvent by the end of the fifth year only at high levels of production. However, few beginning farmers may be able to average 17,000 pounds of milk per cow in the first few years of operation.

The necessary amount of equity increases significantly when higher interest and rental rates are used. When compared with the building renter, the whole-farm rental alternative offers the beginning farmer the best chance for successful entry at low beginning equity levels. In addition, the percentage gain in equity is in general slightly larger for the whole-farm rental situation. The building renter is in a less favorable situation due to the purchasing of all feeds.

While the change in equity over the five-year period was not included as part of the financial solvency criterion, it can have important implications for securing future loans. Depreciation on machinery and equipment was not included in the analysis even though these items must be replaced in subsequent years. If a farm can add to its equity base, additional debt financing to replace depreciated items would be possible. Replacing depreciated facilities would only be necessary after an extended period of time.

The results derived here could change significantly under a different set of assumptions. Caution should be used in extrapolating these results to fit situations that do not fall within the bounds of the model assumptions. In general, the assumptions established are in line with behavior and outcomes on Pennsylvania dairy farms with herd sizes of 40 to 50 cows.

An important factor not considered in this analysis is the risk involved in dairy farming. In a recent case study approach of 37 beginning farmers in New York, Smith and Brake found risk to be a factor of major concern. Farm operators face a host of uncontrollable factors relating to crop and milk production, financing, and market prices under even the best of plans. Accounting for risks in the alternatives analyzed would undoubtedly result in an increase in the starting levels of equity.

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Negatively Taxed Farm Expansion Investments

Gregory D. Hanson

Abstract

The issue of a negative tax on combined land and machinery investments is explored in a sample of Minnesota farms from 1972 to 1978. The expansion investments on ten farms that satisfied test criteria generally resulted in lower tax liabilities and higher tax shielded income. Inclusion of opportunity interest on equity (important for economic decision-making, although not tax deductible) increased annual per farm negative taxation from $533 to $1,546. Preliminary results suggest large tax offsets may be pervasive in combined land-machinery expansion investments. This may result in economic resource allocation inefficiency and affect increases in agricultural real estate prices as land costs are included in cost of production support prices. Critical issues include the amount of equity interest opportunity costs allocated in the model, the assumption that expansion acres are of similar quality to previously owned land, and the likelihood of a continuation in the long-term land inflation trend in U.S. agriculture.

Tax effects upon growth have been traditionally explored in the framework of cost curves. The cost curve approach permits verification of theory, providing a test within the environment or constraints (e.g., cash flow requirements, fluctuating yields and prices, etc.) actually faced by farm operators. In addition, the presentation of before and after tax cost curves constitutes a visually accessible approach within the mainstream of economic analysis of agricultural structure issues. Cost curve analysis recognizing "tax offsets" can distinguish a phenomenon with scale and resource allocation effects not usually anticipated: negative taxation. (The issue of negative taxation in agriculture was recently raised for perhaps the first time in a tax policy study by Davenport, Boehlje, and Martin.)

It will be suggested that producer tax management behavior partially accounts for the widely recognized phenomenon that "Land prices have been bid up to a point where negative cash flows from a land purchase are the rule rather than the exception" (Kay, p. 258). Recent support for the view that the U.S.

Figure 1. Effect of Neutral Income Tax on Costs

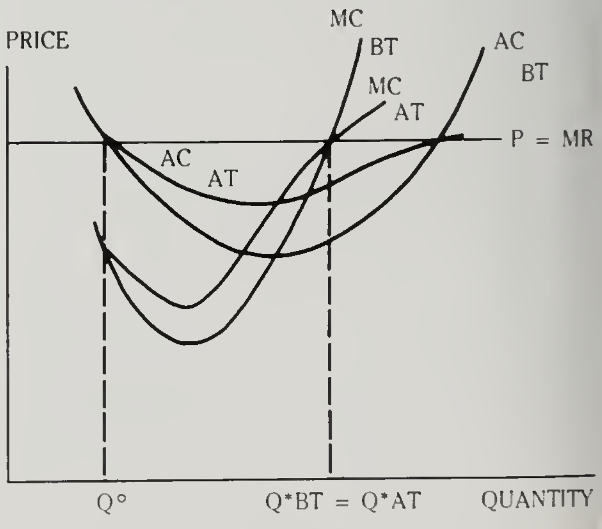

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Table 1. Present Value of Deductions Associated with $40,000 Tractor Purchase, 5-Year Class Life, ACRS Depreciation

	Year				
	1	2	3	4	5
Deduction Value of Investment Credit	13333[a]				
Depreciation (ACRS)	5700	8360	7980	7980	7980
Present Value Total Deduction	19033	7464.29	6361.61	5680.01	5071.43
Total Present Value (.12)	43,610.34				

[a] The tax deductions equivalent of a tax credit D = C/t, where t is the marginal tax bracket of the investor (.3), and C is the credit amount. The depreciation basis has been reduced by 50 percent of the $4,000 investment credit.

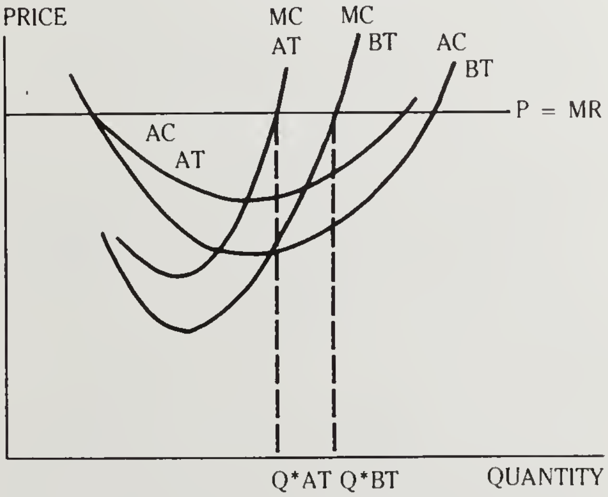
ncome tax system provides powerful nvestment incentives is provided in two pinion surveys of farmers (Otto). For example, 4.8 percent and 55.8 percent of the respective owa and Alabama respondents strongly or moderately agreed that "People often buy land o lower their tax burden" (p.11). More than 95 ercent of the Alabama respondents and 82 ercent of the Iowa respondents similarly greed that the income tax system encourages machinery purchases in years of high income p. 11).

Tax Expenditures in Traditional Cost Curve Models

Until perhaps the late 1960s, agricultural economists in general took for granted the extbook viewpoint that imposition of an ncome tax did not materially change optimal irm output. In effect, the tax allowances for such things as depreciation were assumed to be correct in an economic cost perspective. This situation is depicted in figure 1, where after tax marginal costs are shifted up between Q° and Q*. Government revenues increase (AC-AC_{BT}), but the tax does not affect the profit maximizing activity.

Dean and Carter pointed out in 1962 that if a major cost such as the opportunity cost of equity capital was not tax deductible, optimal output would be less than before tax output. This situation is portrayed in figure 2. However, equity financing is no longer the typical case in farm land investment. Additional purchases of land are frequently highly leveraged (the down payment may actually be borrowed against equity derived from appreciation of past land purchases). With respect to machinery purchases, recent trends to accelerate depreciation have resulted in the possibility that the present value of tax deductions (including the deduction value of the investment credit) can actually exceed the cost of the investment. This is illustrated in table 1. Observe that for an investor in the 30 percent marginal federal income tax bracket with a 12 percent discount rate, the present value of tax deductions exceeds the $40,000 tractor purchase price by $3,610.34.[1]

Figure 2. Effect of Nondeductibility of Opportunity (Equity) Interest on Costs



BT = before tax
AT = after tax
Q* = optimal output

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[1] The tractor is assumed purchased at year end, a not uncommon practice. This result is obviously sensitive to marginal tax bracket and discount rate assumptions. Selection of a 14 percent rate and 40 percent marginal federal income tax bracket results in the present value of tax deductions to be less than the purchase price by $715.24.

Negative Taxes and Cost Curves

When an investment can be written off immediately, it is effectively tax exempt (e.g., Musgrave, p. 343-344). Since in the above example the present value of deductions exceeds purchase price, the effect is stronger than "tax exempt." If the excess deductions can be used to offset previous farm investment income, off-farm investment income, and/or personal income, then the investment generating the tax exemptions can be viewed to be negatively taxed. In addition to depreciation and the deduction value of investment credits, "deductions" affecting the tax attractiveness of investments include (a) exclusions from income such as capital gains deductions and (b) the reduction of taxable income resulting from a shift to a lower tax bracket from a higher current bracket (Bailey). These deductions can affect the tax implications of a machinery purchase if machinery is viewed to be one component of a holistic land-machinery expansion decision. That is, machinery is viewed to be a necessary complement of land expansion (a production-farm management perspective of complementary inputs).[2] Moreover, it can be argued that under current grain input and output price conditions, ordinary income will not likely be generated by the machine (during its lifetime) if accompanied by a highly leveraged land purchase. Sales revenues from corn and/or soybean production may cover variable production costs, but not the interest payment on land purchased with a low down payment at current land price and interest rate levels. The tax loss that can be anticipated on expansion land-machinery investment has value in that it offsets ordinary taxable income on previous investments that are now profitable; e.g., at current commodity price levels (more generally, the tax loss offsets "other income," whether farm or nonfarm).

If the land-machine expansion assets are viewed as complementary inputs, and annual land inflation is expected to occur as a result of the combination of technological advancement, increasing government price supports, and/or general inflationary trends, then the return to the machine investment will ultimately be capitalized into land appreciation. Thus, a combination land-machine expansion converts ordinary income to capital gains income in the form of additional land appreciation.[3] As such, some of the gain will escape taxation; in any case, taxation will be delayed. The gain could escape taxation completely upon death of the purchaser depending upon size of the estate. Finally, note that while tax liabilities associated with income from the asset expansion are at a minimum postponed, and tax liabilities on "other income" are reduced, the purchaser frequently will have the opportunity to borrow against the appreciation on the land purchase as it takes place.

Land-machinery investments may generate both large tax offsets and substantially tax-shielded income in the form of land appreciation (based on long-range land appreciation trends in agriculture). This comprises an ideal form of negatively taxed investment because it has been (a) profitable and (b) quite possibly more profitable than if it were not subject to the income tax since the tax offsets could not be utilized to offset other income. In addition, real estate taxes, variable production expenses and especially interest expense are cash costs that affect the tax-shielding value of land-machinery investments. One can argue that in the past the economic return to an important fraction of these costs was in the form of unrealized capital gains. Just as it is appropriate that these cash costs be included in the benefit-cost analyses of xpansion investments, these cash costs are so included in this study's before tax-after tax ost analysis (also consistent with Dean and arter's treatment).[4]

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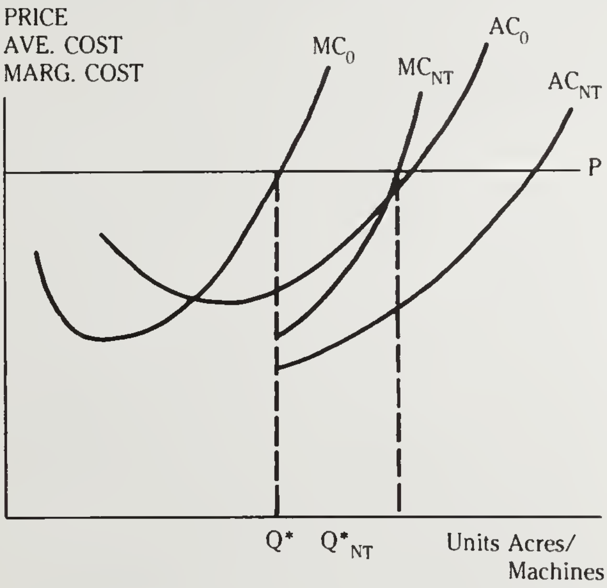
[2] It is acknowledged that land expansion occurs frequently with little or no concomitant machinery investment. However, from a production perspective tillage of additional acres demands that additional costs be allocated for increased wear on machinery. In terms of "use depreciation," the remaining life of a machine is decreased as more acres are plowed, planted, harvested, etc. Thus although a land purchase may not be immediately accompanied by additional machinery investment, machinery replacement schedules will be accelerated.

[3] Since the early 1940s, land appreciation has occurred annually in U.S. agriculture with the exceptions of 1950, 1954, and 1982-1983 (Statistics of Agriculture). The large cost of the Payment-In-Kind Program during 1983 has in this context been referred to as "the cost of land price stabilization." Referring to the tendency for income gains to be capitalized into the limiting input—land—Cochrane writes "The ultimate gainer from a net income increase in agriculture, whether resulting from an increase in demand, a farm technological advance, or a farm program, is the land owner" (p. 371). Melichar recently advanced the view that land is primarily valued as a "growth stock" for its capital gains potential. A brief current discussion of the relationship of farm price and income supports to farm assets is found in Brake.

cquisition of assets that generate tax relief nstead of additional taxes can dramatically hange the cost-scale model. Instead of taxes hifting optimal output left as hypothesized by ean and Carter, the opposite may occur, as is lustrated in figure 3. The before-tax optimal utput (Q*), is determined by the intersection f before-tax marginal cost (MC_0) and product rice (P). Q^*_{NT} less Q* denotes units roduction of expansion assets. (Note that in is model, expansion assets as well as xpansion production are identified; this arginalist convention allocates tax savings to e production unit whose purchase has in fact ade the savings possible.) MC_0 less MC_{NT} can e interpreted as the marginal tax savings that esult from excess deductions on the xpansion investment. In effect, the tax avings property of the expansion investment as reduced after-tax marginal costs of MC_{NT}, nd optimal output correspondingly shifts from * to Q^*_{NT}. The size of the production effect is etermined by the production function and the vel of tax offset generated by the negatively xed investment. (The tax subsidy 'size effect' ill prevail until the increase in marginal costs ssociated with expansion eclipses the vorable effect of tax offsets). In sum, unique pportunities for negatively taxed investments U.S. agriculture provide an incentive to xpand firm size in the presence of other xable income. Farm investments with this uality will eventually find their way into the vestment portfolios of persons (farmers or onfarmers) who do in fact have sizable other come.[5]

Figure 3. Effect of a Negatively Taxed Investment on Costs



Effect of negatively taxed yield on optimal output level.

Q* = optimal output before tax
Q^*_{NT} = optimal output after negative tax

Test Criteria and Methodology

This section illustrates criteria for an empirical est of negatively taxed investment in a farm-records time series and the tax and accounting technique used to determine if expansion investment resulted in reduced taxes and increased economic income.

Test Criteria

Ideal observations for testing the occurrence of negatively taxed agricultural investments would be farms that strictly produce grain for market, do not anticipate expansion until the actual time the expansion occurs, purchase the expansion property in an arms-length transaction, and provide information on the terms of the transaction (i.e., purchase price, mortgage amount, interest rate, and amount of annual payment). This degree of detail is simply unavailable in large farm-record data sets.

The criteria chosen for case selection in this study are: Tillable acres purchased must be greater than or equal to 40, purchase date to be 1972 or later, purchase of expansion land must increase total acres farmed, and cases with large purchases of feeder cattle or frequent changes in acreage are excluded. These modified criteria attempt to ensure that the acres purchased: require production reorganization and thus be considered as a true expansion; set the expansion in a recent time period typical of current conditions; relate machinery and buildings purchases more directly to the land expansion (than would be the case had the expansion land been farmed prior to purchase); simplify allocation of expense and revenue in multi-enterprise farms; and exclude cases where rapid consecutive changes in acreage lend themselves to interpretation and programming difficulties.

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[4] In this respect, Bailey includes cash costs of land clearing in a land purchase example where negative taxation "converts a negative social yield to a positive after-tax private yield" (p. 1161).

[5] Penson found farm families accumulated significant amounts of nonfarm equity capital during the 1970s. In 1973-1974, nonfarm capital accumulation among farmers almost equalled farm capital accumulation.

Allocation of Expansion Revenues and Expenses

Allocation of expenses and returns to enterprises has been, from the farm record standpoint, a difficult issue requiring enterprise allocation assumptions not readily verifiable. The first key assumption in this analysis is that a tillable expansion acre is indistinguishable from pre-expansion tillable acres (the homogeneous acres rule). This permits allocating an input such as fertilizer by the ratio of tillable expansion acres to total tillable acres (after expansion). The homogeneous acres rule permits allocation of crop production value and expenses that are entirely related to crop production (such as fertilizer, pesticides, repair of crop machinery, etc.).

The second allocation assumption is that inputs shared by both crop and livestock enterprises be allocated by the ratio of crop sales to total sales. This assumption is directed at another major category of inputs including interest and depreciation on buildings, electricity, wages, and general farm expense that are shared by both crop and livestock enterprises. The crop share of these expense items is then allocated to the expansion land by the ratio of tillable expansion acres. Inputs such as veterinary, feed purchased, and miscellaneous livestock expenses are clearly not related to the grain enterprise, and can be ignored in land-machinery expansion analysis.

The Tax Simulation Model

The methodology is primarily tax accounting based on a time-series cross section of comprehensive farm record data that includes tax as well as economic variables. An income tax simulation model TAXMODL was used to estimate combined state and federal income and self-employment (social security) taxes individually for each farm. The steps in the model are (1) calculation of adjusted gross income, (2) comparison of the standard personal deduction to itemized deductions, (3) computation of base state and federal income and self-employment taxes, (4) adjustment of base taxes with available business and personal deductions and credits, and (5) estimation of final annual tax liabilities for each tax on income.[6]

The above TAXMODL simulation was first performed based on the total sales, cash expenses, depreciation, and other tax information available in the farm record data. Crop production revenues and expenses attributable to the land expansion are then subtracted from the firm and a second run of TAXMODL is conducted. If tax liabilities have increased compared to the initial run, the land expansion assets qualify as negatively taxed investments (as explained earlier).

The Data

The data base for the study is comprised of farm financial and production records from farm management associations in southern Minnesota. The 76 farms in the sample completed a record each year of the study period 1967-1978, were unincorporated single proprietorships, and maintained the same operator identity between 1967 and 1978. Farm sales and assets averaged respectively $87,500 and $299,700 during the 12 years of the study period. By the last year of the study, 1978, sales had grown to $136,700 and assets to $639,000. Land values were adjusted annually based on county-wide land value surveys of real estate agents, land brokers, and bankers. Machinery and buildings were valued at cost less depreciation; livestock at year-end estimated market prices by the farmers. Major enterprises in the sample consisted of corn, soybeans, hogs, feeder cattle, and dairy.

In addition to farm cashflow and production information, the records include several categories of other income: miscellaneous farm income, labor and machinery custom work eceipts, patronage refunds, investment ncome, other nonfarm income, and farm rogram payments. Family size (personal eductions), church and charitable ontributions, medical expenses, income and elf-employment taxes, and income tax refunds re also included.

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[6] Model tax provisions include: low income credit, income allocation to spouse, net operating loss carry over-carry back, minimum tax (state income tax); earned income credit, optional self-employment method (self employed tax); low income allowance, income averaging, investment credit carry over-carry back, tax surcharge, general credit, net operating loss carry over-carry back, minimum tax (federal income tax). Not all these provisions were in effect every year, and some were modified from 1967 to 1978 as well (such as investment credit rates). Annual changes in tax rates and tax savings provisions for 1969-1978 are included in TAXMODL. See Hanson, p. 60-73.

)uring the years 1972-1978, land expansion reater than 40 tillable acres occurred on 26 of ne 76 sample farms. In only 12 of these cases id the land purchase increase acres farmed n 14 cases the land had been rented for more nan one year prior to purchase). Of the 12 ases where expansion occurred with urchase, two farms purchased large amounts f feeder cattle. Thus, the negative tax test was onducted on ten cases.

'hree of the ten test cases did not produce vestock products. For these farms, estimation f revenues from expansion assets was btained on a pro rata basis based on the xpansion share of total tillable acres. Thus, if ales in a particular year were $100,000 and 00 of total 400 tillable acres were expansion cres, $25,000 in sales were allocated to the xpansion investment (100/400 times 100,000). For the remaining seven farms, alue of expansion production was based upon ushels of corn, soybeans, oats, and wheat, nd tons of alfalfa produced. These production nits were then multiplied by the respective roduct prices used for enterprise analysis by he farm management associations.

Negatively Taxed Expansion Investments

Expansion investment occurred during 1974-1978 for the ten farms satisfying the test criteria (no land expansion took place for these farms during 1972-1973). Tax and expense detail is provided in table 2 on an annual per farm basis (cash and noncash deduction items and their relative size compared to total farm deductions are indicated).

The interest allocation is the first expense number, i.e., $4,084 in 1974. This is the amount of interest actually paid that can be attributed to the expansion investment. Had the entire investment been financed, the difference in pre- and post-expansion tax would be $1,546 instead of $533 (table 2, lower right) and all farms would have experienced negative taxation. The apparent reason for the large equity contribution to the expansion investment was the tremendous increase in farm incomes, particularly from 1972-1975. Compared to the preceding four years, average net income of farm operators increased 86 percent during 1972-1975 (49 percent in 1967 dollars, Statistics of Agriculture). However, had the farmers not employed their increased earnings to expand farm assets, income would have increased by market interest earned on the expansion investment equity. Assuming a nine percent pretax interest rate on that part of the expansion that was financed from equity, the tax computation program estimated that tax liabilities would have increased from $4,449 annually to $5,995 (a $1,546 increase) in the no-expansion case. (Conservative interest rates of eight percent and ten percent for land and machinery loans respectively were assumed in the analysis. While the amount paid for expansion land and buildings was indicated in the farm records, financial terms were not.)

The sum of interest paid, depreciation, and the deduction value of the investment credit is $12,858, or 51 percent of total average deductions for the years 1974-1978 (table 2.) This indicates the large effect tax and financial leverage factors have in investment analysis.

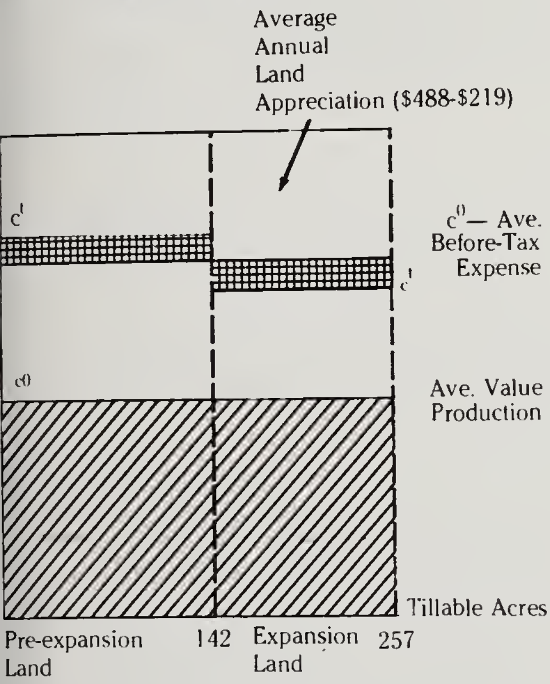
Because annual estimated tax liabilities declined $533 as a result of expansion, or $1,546 depending upon level of financing assumed, and expansion income in the form of land appreciation averaging $25,790 was shielded from taxes (table 2, lower right), sample expansion investments appear to have been negatively taxed. Exclusion of investment credit on the original depreciable assets of the real estate expansion provides an element of conservatism to this estimate. The outstanding result of negatively taxed land-machinery expansion is a significant increase in personal wealth and a reduction of tax liabilities. Further, the after-tax expansion costs are lower on the added acreage than on the pre-expansion acreage. These effects are illustrated in figure 4 for the farm with the second highest level of excess deductions among the test cases.

The line C^0 denotes production expense including opportunity interest on pre-expansion tillable acres. The cross-hatched area to the left of 142 acres represents tax

Table 2. Average Expense, Revenues, and Tax Liabilities Allocated to Combined Land and Machinery Expansion Purchases

Item	1974	1975	1976	1977	1978	Annual Average 1974-1978
	($)	($)	($)	($)	($)	($)
Interest Allocated	4084	4970	4888	5449	4518	4830
(Maximum Allocable Interest) Land and Buildings	6191	5560	5792	6312	6209	6039
Machinery	805	883	981	1063	1235	1021
Depreciation	4943	5066	5797	6186	7664	6098
Machinery	2394	2669	2661	2544	3655	2838
Buildings	2069	2143	2908	2780	3574	2786
Truck and Auto	480	254	228	862	435	474
Real Estate Tax	642	988	1030	1509	1465	1189
Machine Repair	945	1001	1168	1516	1824	1356
Gas, Oil, Lubricants	714	676	776	1187	1416	1006
Fertilizer, Chemicals	4579	5350	4862	5820	7231	5715
Wages, Custom Work, General Expense	2931	2369	2724	3264	4101	3161
Investment Credit Deduction Value	1441	924	1662	1612	3461	1930
Total Expense (Deductions)	20280	21345	22907	26543	31696	25286
Revenues	20882	19139	17848	22392	26625	21761
Excess Deductions	(602)	2206	5059	4151	5071	3525
Change	220	-991	-1309	-337	-238	-533
Tax With Expansion	6392	5705	5167	2692	3588	4449
Tax Without Expansion	6172	6696	6476	3028	3826	4982
Change Tax when Maximum Interest was Allocated	- -	- -	- -	- -	- -	- -1546
Expansion Land Appreciation	23603	20828	27612	26210	28700	25790

ure 4. Negative Taxation Effect on Average Marginal Cost[a]



ased on farm with second largest negative tax savings, erages for 3-year period 1976-78 (expansion occurred ginning 1976). Average after-tax cost on pre-expansion 2 acres is compared with after-tax cost (including tax vings) on 115-acre expansion. Opportunity interest cost cluded on pre-expansion farm land.

ilities in the absence of expansion, or 505 divided by pre-expansion tillable acres. es increased costs approximately $18 per ble acre from $366 to $384.

cross-hatched area to the right of the pre- ansion point likewise indicates the value of ess deductions on the expansion acres. at is, crediting the $2,505 tax savings to the et that actually contributed the savings—the ansion investment—lowers after-tax cost m $366 to $344 per acre (note the ansion reduced the farmer's tax liability to o). Both cross-hatched sections are of equal a for this farm since tax savings on the ansion investment equals tax liabilities had expansion occurred. Since the upper border the left hand cross-hatched area represents pre-expansion cost after tax, while the ver border of the right hand cross-hatched a represents the after tax cost on the pansion land, the line C'C' can be viewed as declining average cost curve or "marginal" erage cost curve. Note also that the after-tax erage cost curve on the expansion vestment lies below the before-tax average st curve pointing out the nature of this gatively taxed investment. The decline in after-tax costs can be viewed as an incentive for expansion in the traditional cost curve framework.

During the years analyzed, estimated average annual appreciation was $269 per acre (figure 4, $488-$219). Even after discounting this capital gain, inclusion of this area transforms a social loss into a personal economic gain.[7] Note also that the increase in land value may serve as a mask for inefficient production practices, offering a positive reward to those that can manipulate their cash flow to handle a land expansion (although not necessarily practicing the most efficient production practices).

Summary and Suggestions for Future Research

The tax-investment model illustrates how investment related expenditures may result in tax deductions which shield income otherwise unprotected from taxes. Income from expansion investments frequently takes the form of land appreciation, and consequently benefits from capital gains deductions and/or estate tax subsidies. Viewed from this perspective expenditures on combined land and machinery investments may result in large tax reductions that produce a downward shift in after-tax marginal and average cost curves providing clear incentives to expand production. In the study ten of the 76 farmer sample met rather stringent negative taxation test criteria, and of these seven were found to have experienced negatively taxed investment. While negative taxation may not be the typical case, its occurrence during inflationary periods, if verified, constitutes an intriguing result in view of long-run inflationary trends in agriculture since the 1940s.

While the results suggest that the occurrence of negative taxation of farm expansion investments is plausible, several insights were also provided. When 100 percent financing was assumed, all ten cases experienced negative taxation benefits. However, at the level of debt financing used, two of the seven cases of negative taxation accounted for most of the tax savings. Off-farm income for the ten farms in the test was 3.4 times the average of the 76 farm sample as a whole during the years 1974-1978 indicating that this may be a factor. There was no clear indication that negative taxation is positively correlated with farm size. The average per acre price for expansion land was $581, while the estimated 1980 value of farmland in the sample region is between $1,500-$1,700.

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[7] Discounting the varying annual land appreciation gains by the eight percent interest rate assumed for real estate purchases reduces the average land appreciation from $269 to $216. In this case the combined value of appreciation and value production is $435, compared to the after-tax cost of production on expansion land, $344.

Farmers can be expected to aggressively bid for expansion land-machinery investments, motivated in part by agricultural tax subsidies (especially during years of high farm prices). Several implications of this behavior are: first, the financial ability to take advantage of large available tax subsidies generated by expansion investment may profoundly affect the prevalent scale of production in agriculture. Second, food prices, if reflecting production costs that include land, will increase as income tax subsidies contribute to land inflation. Third, commercial farmers in pursuit of tax relief may experience lower effective tax rates than people of similar economic income who do not receive significant tax offsets (Sisson). Governments that raise revenues via the income tax may find that the agricultural share of collections declines for this reason (Economic Report of the President). Finally, while this framework may offer insight into one tax phenomenon, dynamic treatments based on high quality microeconomic and aggregate data sets are needed to provide agricultural tax policy analysis with respect to resource allocation and distributional issues.

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onsideration of Farmland alue Variation on Farm Firm urvival

rry R. Skees and Donald W. Reid

bstract

his research demonstrates the importance of eveloping appropriate relationships between come risk and asset risk when modeling rm survival. If these interactions are ignored, e research may grossly underestimate risk d may lead to inaccurate conclusions garding the relative risks that are inherent in fferent size farms. Without these interactions, e smaller farms appear relatively more risky. nce lenders continue to base their decisions both asset values and cash flows, it is sential that farm survival research properly count for the relationships between income d asset values. The Monte Carlo simulation proach presented here offers one alternative.

ey words: farm survival, Monte Carlo mulation, Almon lag land model, risk, come and asset risk.

The number of recent farm business failures has stimulated research interest on causes of failure and conditions necessary for survival of farm firms. In many of these studies the effects of financial structure, farm size, and farm income have been of particular interest. Hanson and Thompson used econometric simulation to determine maximum debt load by farm type and farm size. They found that the maximum feasible debt-to-asset ratio increases with farm size; however, they stressed farm type as possibly the most important variable in determining the successful use of credit. Absolute debt was based on asset values, and farmland was valued at estimated county averages.

Richardson and Condra used a dynamic Monte Carlo simulation-programming model to analyze survival of four sizes of representative irrigated farms in the El Paso Valley. Survival was defined as being able to meet cash commitments, including the ability to borrow against farmland and machinery up to a debt-to-asset ratio of 80 percent. Farmland was valued by applying an inflation factor to the beginning-year value. Results of this study indicated that chances of survival increase as farm size and/or beginning equity increase.

Held and Helmers also used simulation to study farm firm survival. Survival was defined as successfully maintaining a debt-to-asset ratio at or below 60 percent. Consistent with other studies, and as expected, the results indicated that as beginning equity increases and/or as the land appreciation rate increases the rate of survival also increases.

A basic weakness in the simulation studies of farm survival is that such studies ignore the relationship between farm income and farm

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erry R. Skees and Donald W. Reid are assistant professors f agricultural economics at the University of Kentucky. he research reported in this article was conducted at the niversity of Kentucky Agricultural Experiment Station. he simulation model used for this study was developed at lichigan State University with the aid of a cooperative esearch agreement with the Farm Sector Branch, conomic Research Service, USDA. The investigation eported in this paper (No. 84-1-86) is in connection with a roject of the Kentucky Agricultural Experiment Station nd is published with approval of the director.

asset values. Farmland value is particularly significant because of its importance in debt financing. When land values are assumed to be independent of farm income (returns to land), a large component of risk is not considered in evaluating survivability. In periods of low farm income the security base (farmland value) for debt financing decreases; therefore, borrowing potential decreases. Casual observation for the past few years supports this view. The failure to consider this relationship between farm income and land value has implications for analyzing the effect of farm size on survival; as the proportion of farmland to other, perhaps, less risky assets increases, risk of failure may increase.

The purpose of this study is to determine the potential effect on farm survival when land values are explicitly related to returns to land. First, the return-land value relationship and the land value-liquidity reserve relationship are conceptualized. Then, empirical data and relationships are used to analyze four farm sizes to ascertain effects of land values on survival. The study utilizes a Monte Carlo simulation model of representative Illinois corn-soybean farms.

Conceptual Framework

Using asset valuation theory, land values can be conceptualized as the discounted value of expected return to land, i.e.,

$$V = \sum_{t=1}^{\infty} \frac{R_t}{(1+i_t)^t}$$

where V is the present value of land, R_t is the expected returns to land in period t, and i_t is the expected discount rate (required rate of return) in period t. Although this conceptualization abstracts from other influences on value, such as location, it (or some variation thereof) has been useful in explaining land values by many researchers (e.g., Castle and Hoch; Melichar; Reinsel and Reinsel; Lee and Rask; Harris).

Melichar's more restrictive formulation is useful in providing insights into the relationship of return to land and land values. His model is:

$$V = \frac{1+g}{i-g} R$$

where V is the present value of land, R is the current expected return to land, g is the expected growth rate of R, and i is the discount rate (required rate of return). In explaining historical increases in land values, Melichar notes that values can increase in two ways: (a) R, g, or i can change resulting in a new higher equilibrium V and (b) if $g>0$, but $g<i$, the equilibrium value V rises even if g and i remain unchanged. However, since returns to land are stochastic events, it is possible that enough low returns could occur to cause a downward revision in land market participants' expectations about R and g and, perhaps, change their perception regarding returns risk that would increase i. Furthermore, using Melichar's reasoning, if $g<0$, the equilibrium value, V, decreases even if g and i remain constant.

The fact that asset values and returns-to-assets are related has important implications for farm firm survival. Suppose survival is defined as being able to meet all cash commitments. Furthermore, assume that, in order to survive in any given year, cash commitments can be met by cash return on assets, cash reserves, or borrowings. Thus, the potential amount available for covering cash commitments (L) can be expressed as

$$L = \alpha A - \beta A + \tilde{r}A + \alpha\tilde{g}A + CR \quad (1)$$

where A is the value of assets occurring at the beginning of the year, α is the maximum debt-asset allowed by the lender, β is the actual debt asset, $\tilde{r}$ is the risky cash rate of return on assets, $\tilde{g}$ is the risky capital gain (loss) rate of return on initial asset values, and CR is beginning of the year cash reserves. The difference between αA and βA in equation (1) is the beginning of the year borrowing reserve; $\alpha\tilde{g}A$ represents the adjustment to the borrowin reserve because of asset value increases or declines. The $\tilde{r}A$ component represents cash that can be used to meet commitments from current period earnings.

Because of risky components in L, there is risk associated with being able to cover cash commitments. Using variance as an indicator of risk, the variance of L is

$$Var(L) = A^2\sigma_r^2 + \alpha^2A^2\sigma_g^2 + 2\alpha A^2\sigma_{rg} \quad (2)$$

where σ_r^2 is the variance of $\tilde{r}$, σ_g^2 the variance of $\tilde{g}$, and σ_g^2 the covariance of $\tilde{r}$ and $\tilde{g}$. From (2) it is apparent that risk of covering cash commitments increases when risk of changes in asset values is included and is positively related to returns to assets. Therefore, a nsideration of risky asset values should ver the probability of survival for each given ot-asset or, alternatively, the maximum sible debt-asset should be lower.

ne Simulation Model

simulation model is used to demonstrate the ential importance of the return to the land-and value relationship in considering farm n survival. The model develops the financial vironment for Illinois corn-soybean farms h soil productivity ratings of 85-100. (The nois Farm Business Records describes those ls as "farms with nearly level, well-drained irie soils.") In addition, these farms nerally are highly specialized (over 95 rcent of the total tillable acres planted with n or soybeans). Farms with these aracteristics are primarily in central and rthern Illinois. These factors and available ality data were primary reasons for selecting s region and type of farming.

e simulation model is similar to many other dels (e.g., Richardson and Condra, Held and lmers) in that it relies on empirical and ernally-developed economic and cash counting relationships (described in Penson d Lins) to replicate a ten-year period. The ursive financial FORTRAN program is quite xible (Skees). However, only those portions ed for this paper are explained. Variable sts are developed for both corn and beans to facilitate crop mix decisions. The 74-1979 annual *Summary of Illinois Farm siness Records* and the 1979 *Farm Earnings d Production Cost Summary* provide the sic production and cost data. Estimated adratic equations and table look-up nctions (which use linear extrapolation tween data points) are used to tie the lowing items to tillable acres: (a) soil fertility st, (b) machinery fuel and repair, (c) seed d crop cost, (d) machinery and building vestment, (e) insurance and miscellaneous penses, (f) total labor requirement, (g) family bor used, and (h) expected corn and soybean elds.

ch farm has 18 man-months of available mily labor. When this labor is fully utilized determined by the family labor equation), tside labor is hired. Cost and production ationships are developed twice each nulated year: first, for planning purposes to select a crop mix that will maximize returns; and, second, for accounting purposes (using the random prices and yields). Expected prices are developed with naive exponentially smoothed equations and previous year's prices. Expected prices and yields are used in conjunction with a TELPLAN program developed by Black and Vitosh to select the crop mix. The program evaluates the returns from alternative crop mixes by using a yield discount matrix that accounts for trade-offs associated with different levels of specialization in either corn or soybeans given different (discrete) levels of machinery.

At year's end, cash flow projections and a full accounting of available revenue are made. Revenues include the current year's crop, custom harvesting with excess machinery, and interest earnings on outside investments. Cash outflows include out-of-pocket corn and soybean production costs, property taxes (set at .7 percent of the land value), federal income taxes, principal and interest charges on loans, family living withdrawals (a function of previous year's expenditures and after-tax farm income), and any down payment for machinery and building replacement.

Tax provisions of the 1982 tax act are used. For these experiments, grain is not stored. If the cash flow is positive, the excess is placed in a savings account with a return that is equal to the fixed interest rate. If cash flow is negative and there are no savings, short-term loans are acquired. (For these experiments, refinancing of land is not considered.)

For a multiperiod Monte Carlo simulation model, random prices and yields must be correlated within, as well as between years. Correlated random prices and yields were generated with a multivariate, Beta process generator developed by King and modified by Hoskin. A Beta generator was chosen over a normal generator because of the skewed nature of the distributions and the ability to place lower and upper bounds on the random draws (e.g., the lower bound on corn prices in the loan rate). Table 1 presents the parameters used to generate multivariate random corn and soybean prices and yields. Illinois farm-level yield data (1972-1979) were used to develop the yield parameters.

Since prices and yields are correlated between years, as well as within years, a random series

Table 1. Parameters Used to Generate Multivariate Random Corn and Soybean Prices and Yields

Item	Mean	Standard deviation	Upper bound	Lower bound
Corn price	2.67	0.35	3.60	2.25
Soybean price	6.95	0.84	10.04	5.90
Corn yield[a]	0	19.00	44.9	-57.40
Soybean yield[a]	0	6.10	14.8	-22.40

Summary of within year correlations[b]

Corn and soybean prices	0.50
Corn and soybean yields	0.55
Corn yield and corn price	- .27
Soybean yield and soybean price	- .27

Summary of between year correlations

Corn price$_t$ and corn price$_{t+1}$	.50
Soybean price$_t$ and soybean price$_{t+1}$	.35
Corn price$_t$ and soybean price$_{t+1}$	.30
Soybean price$_t$ and corn price$_{t+1}$	.20

[a] The distributions for yields were normalized around a mean of zero in order to provide model flexibility in adjusting expected yields for an individual farm. Expected yields vary as farm size and crop mix vary. Random yields are calculated by adding the random draw to expected yields.

[b] These parameters were used in a 40 by 40 matrix to generate ten years of multivariate, random corn and soybean prices and yields.

that results in either low or high returns will influence land prices. A crucial component of this research is an Almon lag land price model. Hauschew and Herr have demonstrated that such a model performed well in explaining U.S. farm land prices. The following model was developed using 1959-1979 Illinois data:

$$\begin{array}{l} V_t = \underset{(3.39)}{-23.8} - \underset{(79.12)}{210.06}FLB_{t-1} + \underset{(.119)}{.723}CPI_t + \underset{(.012)}{.0068}R_t \\ \quad + \underset{(.0094)}{.069}R_{t-1} + \underset{(.0092)}{.105}R_{t-2} + \underset{(.0091)}{.117}R_{t-3} \\ \quad + \underset{(.0078)}{.103}R_{t-4} + \underset{(.0048)}{.064}R_{t-5} \end{array}$$

where

V_t = the index of Illinois farm land values (1979 = 100);

FLB_{t-1} = the annual Federal Bank interest rate, lagged one year;

CPI_t = the consumer price index (1979 = 100); and

R's = the budgeted returns from previou years with coefficients that follow second degree polynominal (Standard errors are reported in parenthesis).

The R^2 is .997 and the Durbin-Watson statistic suggest no autocorrelation. All signs were as hypothesized and lag structure followed the expected pattern. This model was programme into the Monte Carlo simulator. Since land prices are determined with internally updated random budgeted returns the land price represents a regional price (i.e., central and northern Illinois) for land with 85-100 soil rating.

Data for the Almon lag model were compiled from the Illinois budget data, *Annual Summaries of Illinois Farm Business Records*; and a paper by Scott. A budgeted return-to-land costs was calculated for years 1959-1979 using the actual prices and yields and the nonland cost estimates. Percent of acres planted to corn versus soybeans was based o trends over the period (65 percent corn in 1959-1965, 60 percent corn in 1966-1969, an 55 percent corn in 1970-1979). These percentages were coupled with the historical data to develop the data set on budgeted return per acre. These data were used to fit the Almon lag model.

The Experimental Design

Controlled environments were developed in order to compare results that used the Almon lag model (and provided for land and returns interactions) and those that used a fixed pric of land over the planning period. A general equilibrium, inflation-free environment was created with the following relationships: (a) returns to land of 3.5 percent, (b) fixed intere rate of three percent, (c) intermediate interest rate of 3.5 percent, and (d) short term interes rate of four percent. Fixed and intermediate debt is retired on an amortized schedule wit any negative cash flows covered by short-ter debt.

e only investment over the time period is machinery and building replacement. Thus, erating sizes are fixed over the time horizon. ur sizes of farms (300, 600, 900, and 1,200 res) with full land ownership are simulated each experiment.

Monte Carlo simulation provides the portunity to develop both expected values d measures of variability. Therefore, this ethod provides a means of studying farm rvival under various conditions. Although no tisfactory measures of survival exist, a mmon method is to examine the debt-to-set ratio. In this study, any debt-to-asset ratio at exceeds .8 *in the final year* causes the rm to become insolvent, i.e. it fails.

e simulation experiments are designed so at each farm begins with the same debt-to-set. Clearly, the choice of beginning debt-to-set ratio is subjective. For this set of periments a level very close to the .8 vel—.78—was chosen. The Illinois farm vironment is less risky than most, and oosing a beginning debt-to-asset ratio much wer than .78 would not result in many farm ilures. This is particularly true since farms ly begin with .78 debt-to-asset; they have e opportunity to lower this as they retire ebt over the time period.

nother financial statistic is generated wealth. his value reflects the change in net worth us the stream of family living withdrawals. he calculation is

$$W = (NW_{t=10} - NW_{t=0}) + \sum_{t=1}^{10} C(1+r)^t$$

here

W = generated wealth over the time period;

W = market value net worth;

= consumption expenditures;

= the risk-free interest rate (set equal to the fixed rate); and

= the number of years from the beginning of the simulation period.

Results

Results clearly indicate that incorporation of the interaction between the land markets and returns affect risk. When the land market is related to returns, the odds that the debt-to-asset ratio will be above .8 are 50, 19, 11, and 8 percent for the 300-, 600-, 900-, and 1,200-acre farm, respectively. Without land market interactions, only the 300-acre farm exceeds this constraint (42 percent). The properties of ending debt-to-asset ratios are reported in table 2. Although the mean differences in ending debt-to-asset ratios are different when comparing results with and without land market interactions, they are not significantly different. However, relative measures of risk, such as standard deviation or coefficient of variation, are more telling. The most striking comparison is between the coefficient of variation with and without land market interaction. These values suggest that the relative risk (when examining debt-to-asset ratios) increases by roughly 2.5 times for all farms when land market interactions are considered.

Examination of generated wealth values suggests that relative risks are even greater when land market interactions are modeled. In

Table 2. Simulation Results That Account for Land Market Interactions Compared to Those That Do Not[a]

Farm Size	300 ac	600 ac	900 ac	1200 ac
With Land Market Interactions				
Ending Debt-to-Asset				
Mean	.801	.716	.692	.681
Std deviation	.100	.092	.089	.087
Coef of variation	.1250	.1288	.1285	.1277
Generated Wealth (in $1,000)				
Mean	197	387	547	696
Std deviation	135	258	376	493
Coef of variation	.685	.667	.687	.708
Without Land Market Interactions				
Ending Debt-to-Asset				
Mean	.790	.705	.681	.671
Std deviation	.039	.038	.036	.035
Coef of variation	.0491	.0540	.0533	.0519
Generated Wealth (in $1,000)				
Mean	200	394	558	710
Std deviation	53	92	124	154
Coef of variation	.265	.234	.222	.211

[a] Statistics were developed from 100 simulations. (i.e., 100 ten-year periods were developed with random price yields.)

addition, relative risk increases as farm size increases. The coefficient of variation is 2.6, 2.9, 3.1, and 3.3 times greater for the 300-, 600-, 900-, and 1,200-acre farm respectively. Therefore, studies that ignore land market interactions not only underestimate risk but may also misrepresent the relative risk of different size farms.

Conclusions

This research demonstrates the importance of developing appropriate relationships between income risk and asset risk when modeling farm survival. If these interactions are ignored, the research will underestimate risk and may lead to inaccurate conclusions regarding the relative risks that are inherent in different size farms. Further research is needed to investigate these relative risks. Since lenders continue to base their decisions on both asset values and cash flows, it is essential that farm survival research properly account for the relationships between income and asset values. The approach presented here offers one such alternative.

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AGRICULTURAL FINANCE REVIEW, Department of Agricultural Economics
Cornell University Volume 45

PREFACE

Agricultural Finance Review provides a forum for presentation of research and discussion of issues in agricultural finance. Publication is annual, and all articles are contributed by scholars in the field. Articles on assigned topics may be commissioned occasionally.

Volume 43 was the first to be published at Cornell University. The previous forty-two volumes were published by the United States Department of Agriculture. AFR was begun in 1938 by Norman J. Wall and Fred L. Garlock, whose professional careers shaped much of agricultural finance research for many years. Since that time, professional interest in agricultural finance has continued to grow, involving larger numbers of people and a greater diversity in research topics, methods of analysis, and degree of sophistication. We are pleased to be a part of that continuing effort and development, and we invite your suggestions for making improvements in *Agricultural Finance Review.*

The effectiveness of this publication as a means of promoting agricultural finance research and discussion depends on its support by the profession. We have been pleased by the response in these first three years both in terms of manuscripts received and willingness of the profession to review submitted manuscripts. Twenty-three manuscripts were received for volume 45. The eleven contained herein were selected for publication. We thank all those who submitted manuscripts for our consideration.

We express our sincere thanks to the following individuals who contributed their valuable time to review submissions for us:

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Manuscripts for the 1986 issue should be received by February 1, 1986. Manuscripts will be accepted at any time, however, and those received after February 1, will be considered for the 1987 issue.

John R. Brake, editor
Eddy L. LaDue, associate editor
Loren Tauer, associate editor

nancial Distress on ennsylvania Dairy Farms

am Grisley

stract

financial position of a large sample of
nsylvania dairy producers is examined for
and projected to 1985. Five different
assistance programs are investigated to
rmine the number of severely and
erately distressed farms that would be
sted enough to remain in business. The
t costs of these programs to lending
tutions are calculated. Per farm costs
ed from $19,589 to $58,977 for the
rely distressed group and from $14,764
39,305 for the moderately distressed
p.

words: dairy farmers, financial stress,
assistance programs.

The U.S. agricultural sector is undergoing a period of financial distress that will almost certainly result in an increase in the rate of farm bankruptcies and a decrease in the number of farms. As lenders to the farm sector, commercial banks, agricultural supply vendors, and others will also experience financial distress. The extent of the problem and major reasons why agriculture has become financially distressed was recently reviewed by Melichar. Eleven percent of U.S. farms in 1984 had leverage ratios between 41 and 70 percent, and eight percent had leverage ratios exceeding 70 percent. Given current prices and costs in agriculture, these highly leveraged farms are unable to meet interest obligations on their debt, let alone paying-down any principal. A more recent report from Iowa State University detailed the extent of the problem in Iowa and found similar results.

Evidence suggests 20 to 30 percent of farmers nationwide currently have financial problems, and the situation could become more severe if commodity prices remain low and asset values continue to deflate (Iowa State Report). The dairy industry suffers many of the same financial problems of grain farmers, but the dairy industry's problems may be more severe in terms of finding a workable, long-term solution. Unlike grain prices, which hold some potential for upward movement given changes in world supply and demand conditions and changes in currency exchange rates, milk prices are likely to remain static or even decrease over the next few years. As a result, dairy farm incomes will decrease and high debt and inefficient farmers may be forced into bankruptcy and/or liquidation. However, allowing large numbers of high debt dairy farmers to go bankrupt may not be either

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omics at The Pennsylvania State University. The
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stance by Isabel Martinec.

politically feasible or economically wise. Farm debt is held by lending institutions and supply vendors, many of which are currently having financial problems. Forcing large numbers of highly leveraged farmers into bankruptcy would result in immediate losses by lending institutions and may exacerbate the downward pressure on real estate and used farm machinery and equipment prices. Supply vendors would certainly be in a less favorable position, since most of their loans are not secured by collateral.

A question of major concern is whether losses could be minimized if lending institutions were offered incentives to restructure or write down a portion of the existing debt and reschedule the remainder on terms farmers could financially handle. A limited program of this nature was announced by the USDA in the fall of 1984 and a modified version was offered in early 1985. By allocating the financial risks among lending institutions, government, and individual farmers, losses could be minimized.

Various programs have been suggested to assist qualified financially distressed farmers avoid bankruptcy (Boehlje). These include rescheduling all or part of existing debt, debt buy-out and refinancing with longer term maturity, partial or full moratorium on principal and interest for a limited number of years, debt set-aside, partial debt write-down, and interest rate reductions. Depending on the specifics of the program and eligibility requirements, farmers could remain in business and lending institutions may be able to minimize their overall losses with a minimum of government assistance. Importantly, notice would be served on farmers to get their financial house in order or face the prospect of bankruptcy. A number of highly leveraged dairy farmers are efficient milk producers and could survive the current financial crisis with a minimum of assistance. This would apply even if milk support prices are reduced further.

The purpose of this paper is twofold. First, a selected sample of Pennsylvania dairy farmers is examined to determine the most recent financial position of a large number of farmers. The financial positions are then projected to 1985. Secondly, five different alternative policies for reducing principal and/or interest payments are evaluated on the 1985 projected financial positions to determine the number of farmers who would benefit enough to continue in business. The alternatives considered are not recommendations, but are simply used to test the extent to which they might assist financially distressed farmers.

This paper has four main sections and a conclusion. In section one the area of study, methodology, assumptions, and alternatives for relieving debt payment stress are identified. Section two contains a discussion of the current financial position of farms. Section three presents budgeted projections on financial positions for 1985. The projected costs of various debt assistance programs are discussed in section four.

Area of Study and Methodology

Farm level data are taken from the Pennsylvania Farmers Association's (PFA) annual records for 1979 and 1983. Data for 1983 are used to determine the current financial position of farms and as a baseline to make projections for 1985. For comparative purposes, the financial position of farms in 1979—a high profit year—are compared to those in 1983. These data are from dairy farms that milk 20 cows or more and receive more than 50 percent (average of 94 percent) of their gross receipts from the sale of milk. The number of farms used in the analysis was 914 in 1979 and 1,477 in 1983. Approximately 50 percent of the farms in the 1979 sample were represented in the 1983 sample. Dollar values in 1979 were adjusted to constant 1983 dollars by the implicit price deflator for personal consumption expenditures.

The 1983 PFA sample comprised about 10.5 percent of farms and 13.1 percent of milk cows in the state. Average herd size for the PFA sample was 65 cows and the state average was 53 cows. Average production per cow for the sample was 14,065 pounds and the state average was 12,939 pounds. The extent to which the PFA sample differs from the state average with respect to debt and asset levels is not known.

The criterion used to determine the financial osition of a farm was the year-ending esidual cash flow (RCF), defined as returns bove operating expenses, interest and rincipal payments, and adjustments for hanges in feed and supply inventories and ccounts payable and receivable. This esidual is the amount the farm operator has emaining to pay family living expenses and ncome taxes, depreciation replacement, and dditions to the capital stock. Even though RCF is not all cash, current assets in nventory are highly liquid and can be onverted into cash. Off-farm income was not onsidered in the analysis because data were navailable. The omission of off-farm income n an investigation of farm business financial osition can result in an overstatement of the roblem. As recently noted by Melichar, off-arm income is sizable for smaller farms. However, dairy production involves daily abor operations and management. Farmers with 30 cows or more are full-time operators nd most have little time for off-farm mployment.

Farms were categorized into three groups by RCF: (a) severely distressed; (b) moderately distressed; and (c) financially sound. The severely distressed group included farms with a zero or negative RCF. Without nfusions of outside funds, refinancing, or estructuring of debt, these farms will not be ble to continue in production. The moderately distressed group includes farms that have RCFs falling in the range of $1 to $15,000. These farms can meet all expenses and pay part of the family living expense. Farms in the financially sound group have RCFs exceeding $15,000. These farms have sufficient income to pay all farm and family living expenses and in certain cases, make new investments for growth.

Actual results in 1983 were adjusted at the farm level to arrive at projected RCFs for 1985. A budgeting technique was used to arrive at the 1985 projections. Assumptions were made on changes in operating expenses, milk production per cow, milk prices, and crop yields. Herd size and crop acres were assumed to remain static at 1983 levels. All operating expenses except interest were assumed to increase at an annual rate of 1.5 percent, equal to the increase in the prices-paid index by farmers from 1983 to October 1984 (*Agricultural Outlook*, November 1984). Average operating expenses were $89,448 per farm in 1983. Milk production per cow was assumed to increase at 1.5 percent per year, equal to the annual average rate of increase of farms in the PFA record keeping service from 1979 to 1983 (*Pennsylvania Dairy Farm Business Analysis*, 1979 to 1983). Two assumptions were made on milk prices. First, prices were reduced 50 cents, and secondly, $1 per hundredweight less than the farm gate price received in 1983. The average price received for all milk at the farm level in the 1983 PFA sample was $12.75 per hundredweight.

Since 1983 was a drought year, resulting in lower than average crop yields, yields in the 1985 projections were adjusted to 1982 levels —a year considered to be average for crop production, with corn yields at 96 bushels per acre, corn silage at 15.5 tons per acre, and hay equivalent at 3.3 tons per acre. Using 1982 and 1983 PFA records, crop yields were adjusted by herd-size group. 1985 harvest period futures market prices for grains, and an assigned price of $28.50 per ton for corn silage and $75 per ton for hay were used in the calculation.

The RCF projections for 1985 with milk prices 50 cents less per hundredweight were used as the basis from which to evaluate financial distress under different debt assistance alternatives. Five policies that affect the level of debt and annual principal and/or interest payments were considered. Policy A was a moratorium on all principal payments for a period of five years. Interest payments on all debt would continue over the five-year period at 1983 levels. Policies B and C were refinancing programs of all debt. Under B, debt was refinanced at a 14 percent interest rate over a period of 25 years, assuming an annual amortized repayment schedule. The interest rate used approximates the rate charged by the Federal Land Bank for long-term loans in 1983 and 1984. To evaluate the effect of a subsidized rate, the interest rate under Policy C was decreased to seven percent for the first five years of the 25-year period. Policy D was a 25 percent set-aside on all principal and interest for a period of five years. Payments for the remaining 75 percent would continue as scheduled in 1983. Policy E was an immediate 10 percent write-off of all debt. Principal and interest payments on the remaining 90 percent of debt would continue as before the write-off. Policies D and E are similar to the announced program of USDA in the fall of 1984.

The effect of policy alternatives on projected cash flow was evaluated for a single year only. No guidelines were established as to which farmers would be eligible. The purpose of the analysis is to show the number of farmers that would be assisted enough to move from the severely to the moderately distressed category and to move from the moderately distressed to the financially sound category.

Current Financial Position

Total debt per farm is reported in table 1 by herd size and debt-to-asset ratio groups and for all farms in 1983. One-hundred and forty-three, or 9.7 percent, of the 1,477 farms studied were debt free. Fifty-eight percent of these farms had less than 60 cows. Debt as a percent of assets averaged 34 percent from farms with debt and 31 percent across all farms. By comparison, these percentages were 24 and 22 percent, respectively, in 1979. Average debt per farm was $153,400 and average debt per cow was $2,417 for farms with debt. For all farms these values were $138,548 and $2,183, respectively. Farms with debt in the largest herd size group has the highest debt per cow at $2,563, and the smallest group had the lowest at $2,190. Across all farms with debt, an average of 56 percent of the debt had maturity exceeding 10 years. Smaller farms, and farms with lowe debt-to-asset ratio had a smaller percentage of long-term debt. The 218 farms, or 16 percent, with debt-to-asset ratios of 0.60 or greater had 32 percent of the total debt. Average debt for these farms was $300,882.

The average rate of return on equity, defined as net farm income before family withdrawals or a charge on equity investmen and divided by year ending market value of equity, was 2.4 percent for all farms (table 1). By comparison, the average rate of return on equity was 6.7 percent in 1979. Average rate of return on equity was positive for farms with less than 45 percent debt and negative at higher debt levels. In general, this pattern was consistent across farms with different herd sizes. These results indicate that high debt farms were not receiving a positive return on equity invested. Even without deflation in the market value of assets, these farms were using up their equity. If continued over a period of time, total farm borrowing capacity would decrease, making refinancing and gaining access to additional credit more difficult.

Table 1. Number of Farms and Total Debt Per Farm by Debt-to-Asset and Herd-Size Groups and Rate of Return on Equity by Debt-to-Asset Groups, Pennsylvania Dairy Farms, 1981.

	Herd size in cows per farm												
	20 to 39[a] (333)		40 to 59 (529)		60 to 79 (309)		80 to 99 (132)		100 or more (174)		All farms (1,477)		
Debt as % of assets	No. farms	$1,000 of debt	No. farms	$1,000 of debt	No. farms	$1,000 of debt	No. farms	$1,000 of debt	No. farms	$1,000 of debt	No. farms	$1,000 of debt	% return[b] on equity
0	48	0.0	54	0.0	27	0.0	6	0.0	8	0.0	143	0.0	4.7
1 to 14	112	21.9	136	34.3	94	43.7	28	41.5	33	86.4	403	37.3	3.3
15 to 29	66	58.2	115	83.3	60	121.3	30	169.4	36	230.4	307	111.0	2.5
31 to 44	52	100.3	80	152.1	54	197.7	26	249.6	37	377.9	249	194.9	1.4
45 to 59	17	131.5	58	190.7	34	263.1	21	314.6	27	464.5	157	263.6	–0.04
60 to 79	24	152.3	55	223.5	24	260.5	12	381.5	19	486.8	134	268.9	–4.1
80 or more	14	185.8	31	260.4	16	370.7	9	407.1	14	663.9	84	351.9	–14.1
All Farms with debt	285	70.2	475	121.8	282	152.5	126	218.9	166	338.6	1,334	153.4	2.4[c]

[a] Herd-size group: number of farms per group in parentheses, number of farms by debt-to-asset and herd size groups, and $1,000 of debt is thousands of dollars of total debt per farm.

[b] Net farm income divided by total equity investment.

[c] Average for all farms.

Residual cash flows for 1979 and 1983 are summarized by debt-to-asset ratio groups in table 2. For each group, farms were classified as either severely, moderately, or not financially distressed. A comparison of RCFs between 1979 and 1983 shows the extent to which financial problems have increased. Seventy-eight, or nine percent, of the 914 farms studied in 1979 had RCFs that were zero or negative and 119, or 13 percent, had RCFs between $1 and $15,000. Even in the best of years a significant proportion of farms were having financial problems. By comparison, 360, or 24 percent, of the farms in 1983 had a zero or negative RCF and 364, or 25 percent, had an RCF between $1 and $15,000. For all farms, average RCF was $38,200 in 1979 and $14,800 in 1983, a 61 percent decrease over the four-year period.

Higher leveraging increased the percentage of farms with severe cash flow problems in both years. The problem was more pronounced in 1983 as 20 percent or more of the farms in each debt-to-asset ratio group exceeding 14 percent debt had severe financial problems. Forty-nine percent of the farms in the 60 to 79 debt-to-asset group and 41 percent in the 80 and over debt-to-asset group have a zero or negative RCF. In 1979, only the group with 80 or more percent of debt had a high percentage of farms in the severely distressed category. Notably, a significant number of farms in the high debt

Table 2. Average Residual Cash Flow by Debt-to-Asset Ratio, Actual 1979 and 1983 and Projected 1985 Before Debt Assistance Options, Pennsylvania Dairy Farms.

	Actual, 1979		Actual, 1983		Projected, 1985 (Milk, $0.50 Less/Cwt)		Projected, 1985 (Milk, $1 Less/Cwt)	
Debt as % of assets	No. farms	$1,000[a] residual cash flow	No. farms	$1,000 residual cash flow	No. farms	$1,000 residual cash flow	No. farms	$1,000 residual cash flow
0	1[b]	-2.0	3	-3.2	1	-6.0	3	-3.5
	7[c]	9.3	19	9.5	15	8.8	17	9.3
	75[d]	60.6	122	42.3	127	47.5	123	44.4
1 to 14	7	-13.7	41	-13.0	24	-14.5	30	-14.2
	18	9.9	96	8.3	72	8.9	90	8.6
	199	53.1	266	40.0	307	45.9	283	43.7
15 to 29	17	-26.6	61	-18.4	35	-19.2	43	-18.3
	24	8.6	90	8.5	62	8.6	80	8.8
	175	52.0	156	33.7	210	38.8	184	36.9
30 to 44	16	-24.5	100	-25.2	75	-21.8	90	-21.7
	15	9.7	55	7.6	51	7.4	54	7.8
	137	48.0	94	39.2	123	44.5	105	43.3
45 to 59	17	-40.4	55	-38.4	44	-37.2	51	-36.6
	32	7.9	46	6.3	38	7.7	38	6.6
	80	43.7	56	32.7	75	40.6	68	37.1
60 to 79	13	-54.1	66	-31.3	50	-31.2	59	-30.3
	15	8.7	40	7.4	38	8.4	38	8.0
	43	44.0	28	33.5	46	33.6	37	32.5
80 or more	7	-47.1	34	-40.2	25	-45.4	30	-41.4
	8	6.4	18	8.1	22	8.2	18	6.4
	8	44.6	32	36.4	37	44.0	36	39.4
All farms	78	-34.1	360	-27.0	254	-27.0	306	-26.4
	119	8.6	364	7.9	298	8.3	335	8.1
	717	50.9	753	38.0	925	43.2	836	41.1
Summary	914	38.2	1,477	14.8	1,477	24.0	1,477	19.6

[a] The residual cash flow for 1979 was adjusted to 1983 constant dollars by the implicit price deflator.

[b] Number of farms with a zero or negative residual cash flow.

[c] Number of farms with a residual cash flow between $1 and $15,000.

[d] Number of farms with a residual cash flow greater than $15,000.

groups had RCFs exceeding $15,000. These farms may have been more efficient than their counterparts with zero or negative RCFs, but could also have had more favorable financing terms. Since farmers' estimates of the market value of real estate and intermediate assets were used in measuring asset values, some of the farms falling in the high debt groups may have occurred because of an undervaluing of assets.

In summary, a higher percentage of farms in 1983 had severe financial problems than in 1979. Severe financial problems occurred at lower debt-to-asset ratios in 1983 as compared to 1979. While 1979 was considered to be a good year for dairy producers, these results do indicate increasing numbers of farmers were having financial problems by 1983. The results also indicate 51 percent of farms in 1983 were realizing large cash flows, an average of $38,000 per farm. This group in 1979 comprised 78 percent of the farms and averaged $50,900 in RCF.

Projections for 1985

Projected RCFs were budgeted at the farm level for 1985 using the assumptions outlined in section one. For comparative purposes, RCF was budgeted first with milk prices at 50 cents, and secondly, at $1 per hundredweight less than actual farm-gate prices received in 1983. Two-hundred and fifty-four, or 17 percent, of the farms had a zero or negative RCF, and 298, or 20 percent, had an RCF between $1 and $15,000 when milk was decreased by 50 cents per hundredweight (table 2). The number of farms with severe cash flow problems decreased from the actual in 1983 because higher yields on grain and corn silage were assumed in the 1985 projections. At milk prices $1 per hundredweight less, 306, or 21 percent, of the farms were projected to have severe financial problems, and 335, or 23 percent, were projected to have moderate financial problems. These percentages are only slightly less than the actual percentages for 1983. By decreasing the price of milk from 50 cents to $1 per hundredweight less, an increase in 52 farms had zero or negative RCFs.

These results show a significant number of farms could have severe financial problems by 1985, even if 1985 crop yields reach the 1982 average. Preliminary evidence from PFA field personnel suggests farmers have been able to pay-down some debt in 1983. If debt loads have been decreasing, the percentage of farms that will have severe financial problems could be less than projected here. However, farmers with the most severe cash flow problems are least able to pay off debt unless outside funds are available.

It is not known how the financial position o the 1,477 farms studied compares to all farms in the state. As noted above, the sample studied had a larger average herd size and produced higher levels of milk per cow. The difference in production suggest farms in general are worse off than those sampled, assuming a similar distribution of debt-to-assets. For lack of a better measure on the number of farms statewide that could have financial problems by 1985, the above results projected for 1985 are extrapolated to the state level. Extrapolating the percentage of farms projected to have severe and moderate financial problems at a milk price of 50 cents per hundredweight less than 198 prices, gives a total of 2,520 farms in the severely distressed category and 3,080 in the moderately distressed category. With milk prices at $1 per hundredweight less, 3,200 farms fall in the severely distressed category and 3,360 in the moderately distressed category. While these figures are extrapolations from projected numbers, they may indicate that a large number of dairy farmers could have financial problems by 1985.

Effects of Policy Alternatives

Five policy alternatives designed to assist financially distressed farms were evaluated. No criteria were established to determine which farmers could be eligible for assistance. The source of debt financing wa not known, and all farms were therefore assumed to borrow from a common lender. In practice, a debt servicing assistance program would be specific to the type of lending institution, depending on whether it is private, public, or a farmer-owned cooperative. Farms with moderate and no financial problems were included in the tabulation to show how many farms would change financial position categories. In application, farms with higher cash flows in the former group and all farms in the latter group may not be eligible for, nor require financial assistance. To reiterate, Policy A is a moratorium on all principal payments for five years, Policy B is refinancing of all debt at 14 percent interest for 25 years, Policy C is identical to B except the interest rate is seven percent for the first five years of the loan length, Policy D is a 25 percent reduction on principal and accrued interest for a five-year period, and Policy E is a 10 percent permanent write-off on outstanding debt. Under Policies A, C, and D, principal and/or interest payments would increase after a period of five years, but this effect would not be observed in 1985.

Effects of the policy alternatives on RCF are reported in table 3. Under Policy A, 54 of the 254 severely distressed farms remained in that category. One-hundred and fifty-one farms moved from the severely distressed to moderately distressed category and 49 moved from the severely distressed to financially sound category. Two-hundred and ninety-eight farms in the moderately distressed category moved to the financially sound category. A moratorium on principal payments would clearly help a considerable number of farmers and could, if the moratorium was long enough, enable many financially distressed farms to work out of their financial crises.

Under Policy B, 177 of the 254 financially distressed farms remained in that category. Only 77 percent of the 254 farms projected to be severely distressed in 1985 would be significantly assisted enough under a debt refinancing program with an interest rate at 14 percent over a 25-year period to move to the moderately distressed category. Reducing the interest rate to seven percent in refinancing Policy C, left only six percent or 86 farms in the severely distressed category. Sixty-six percent, or 168, of the 254 severely distressed farms would move to the moderately distressed category. Two-hundred and fifty-three farms would move from the moderately distressed to the financially sound category.

Table 3. Summary of Financial Position of Farms Under Debt Assistance Policy Alternatives, Projected 1985, Pennsylvania Dairy Farms

Policy alternative	No. farms	Percent farms	$1,000 residual cash flow after debt assistance, 1985
Projected 1985[a]	254[b]	17	–27.0
	298[c]	20	8.3
	925[d]	73	43.2
A. Moratorium on principal payments for 5 yrs.	54	4	–16.8
	157	10	9.7
	1,272	86	56.8
B. Refinancing at 14% and 25 yrs.	177	12	–17.8
	293	20	8.5
	1,007	68	45.7
C. Refinancing at 7% and 25 yrs.	86	6	–16.5
	218	14	8.7
	1,178	80	48.6
D. 25% reduction on principal and interest for 5 yrs.	101	7	–28.4
	202	14	8.7
	1,174	79	54.1
E. 10% write-off on principal	134	9	–29.8
	213	14	7.8
	1,130	77	52.0

[a] The projected results for 1985 without any assistance are included for comparative purposes (see table 2, Actual 1983, all farms).

[b] Number of farms with a zero or negative residual cash flow.

[c] Number of farms with a residual cash flow between $1 and $15,000.

[d] Number of farms with a residual cash flow greater than $15,000.

Under Policies D and E, seven and nine percent, respectively, of the severely distressed farms would remain in that category. The 25 percent reduction in principal and interest payments under Policy D would enable 153 farms to move from the severely to moderately distressed category Two-hundred and forty-nine would move from the moderately distressed to the financially sound category. Under Policy E, 120 farms would move from severely distressed to moderately distressed category, and 205 would move from the moderately distressed to financially sound category. The variation in projected financial positions of farms under policies D and E approximate the variation in the actual financial position of farms in 1979.

Projected Costs of Policy Alternatives

A question of considerable interest is the cost to lending institutions of the various debt assistance policy alternatives considered. Since actual interest rates, remaining length of loans to maturity, and repayment schedules were not known with certainty, an approximation was used in calculating the costs. Under those policy alternatives that would have costs over each of the five years (Policies A, C, D, and E), the present value of the costs was calculated using a discount rate of 10 percent. No administrative or other secondary costs were considered in the calculations.

Under Policy A (a moratorium on all principal payments for five years) the interest revenue foregone by the lender over the five years on these payments was calculated using an interest rate of 14 percent. The cost of Policy B was not calculated because it was a refinancing program of total indebtedness at 14 percent interest for 25 years. However, lending institutions would almost certainly face higher risks in refinancing since much of the debt would not be secured by collateral. If government insured the refinancing program at some percentage of total indebtedness, risks to the lending institutions would decrease, but risks to the government could be substantial. The cost of Policy C would be the subsidized interest rate of seven percent on all debt for five years. Under Policy D, the cost would be the revenue foregone by the lender on 25 percent of the principal and interest for a period of five years. The cost of Policy E would be an immediate loss of 10 percent of the outstanding principal. The cost of the government guarantee on some percentage of the remaining debt was not considered in the calculation, even though it could be substantial if a large number of farmers are forced into bankruptcy in later years.

In calculating the direct cost of the alternative policies, only those farms in the severely distressed category and those in the moderately distressed category with RCFs of $5,000 or less that would be assisted by the policies were considered. That is, only the financially distressed farms that could be assisted enough to move out of that category and the moderately distressed farms with $5,000 or less RCF that would be assisted enough to move out of that category were considered. It is unlikely that farms in the severely distressed category who could not show a positive RCF with assistance would be eligible. Farms with RCFs exceeding $5,000 may also not be eligible and were not considered.

The number of farms assisted, average program cost per farm, and average farm net worth for the sample studied are shown in the upper part of table 4. These costs were extrapolated to farms on a statewide basis in the lower part of the table. Program costs for sample farms that would be assisted enough to move from the severely distressed group ranged from $19,587 to $58,977 per farm. The 10 percent write-off on the principal, Policy E, had the lowest cost per farm, but assisted the fewest number of farms. Average net worth of the 120 severely distressed farms assisted under Policy E was $235,000 in 1983 The costs for the moderately distressed group with 1985 projected RCFs of less than $5,000 ranged from $12,465 to $39,305. Subsidizing the interest rate for five years at seven percent was the most costly program. The farms assisted in the moderately distressed group under all policy alternatives had a smaller average net worth than farms in the severely distressed group. When summed across all farms assisted, even the least costly program would involve significant direct losses for lending institutions.

Table 4. Number of Farms Benefiting From and Direct Cost of Debt Assistance Policy Alternatives, Pennsylvania Dairy Farms

Policy alternative	Severely distressed 1985[a]			Moderately distressed 1985[b]		
	No. farms	Debt assistance cost per farm	Equity per farm $1,000	No. farms	Debt assistance cost per farm	Equity per farm $1,000
,477 sample farms						
A. Moratorium on principal payments for 5 years	200	$24,989[c]	$151	111	$12,465[c]	$167
C. Refinancing at 7% and 25 years	177	58,977[c]	249	129	39,305[c]	191
D. 25% reduction on principal and interest for 5 years	153	38,065[c]	237	158	27,278[c]	192
E. 10% write-off on principal	120	19,589	235	156	14,764	202
4,000 Pennsylvania farms[d]						
A. Moratorium on principal payments for 5 years	1,896	20,366[c]		1,052	10,159[c]	
C. Refinancing at 7% and 25 years	1,678	48,066[c]		1,223	32,033[c]	
D. 25% reduction on principal and interest for 5 years	1,450	31,623[c]		1,498	22,223[c]	
E. 10% write-off on principal	1,137	15,965		1,479	12,033	

Farms in the projected severely distressed category that would be able to realize positive residual cash flows.

Farms in the moderately distressed category with projected cash flows of $1 to $5,000 in 1985 that may be eligible for assistance.

These debt assistance programs would have costs over a five-year period. The costs reported have been discounted using a discount rate of 10 percent.

Extrapolating to statewide basis assuming average farm is 81.5 percent as large as the average farm in the sample studied.

Extrapolating these results to the 14,000 dairy arms in the state shows that considerable sums of money would be involved. Per farm costs at the state level would be less than hose in the sample because farm size is smaller. Summing across farms that may be eligible for assistance shows all debt assistance programs to be costly.

Summary and Conclusions

The current oversupply problem in the dairy ndustry serves as a strong economic argument to reduce milk support prices. In ate 1983 and early 1984 milk prices were reduced and further reductions could occur in early 1985. These reductions come at a time when large numbers of dairy farmers are having financial problems, primarily as a result of high levels of indebtedness. Many high-debt farms could be forced into bankruptcy and/or liquidation. This situation could accelerate the downward pressure on real estate and machinery and equipment prices and result in low rates of debt recovery from liquidated farms and a forced write-down of secured collateral on remaining farms with debt. If incentives were offered to restructure or refinance outstanding debt, lending institutions could minimize their losses, and the more efficient dairy farms with high levels of indebtedness may be able to work their way out of the current financial crises.

In 1983, 24 percent of the 1,477 dairy farms in the Pennsylvania Farmers Association's record keeping service had residual cash flows that were zero or negative and 25 percent had positive cash flows of less than $15,000. The former group could not pay all interest and principal payments and had no income remaining for family living expenses. Without infusions of outside funds or rescheduling or refinancing of existing debt, these farms will not be able to continue in business. By comparison, 9 percent of farms in 1979 were severely distressed and 13 percent were moderately distressed. The projected financial position of farms in 1985 was not as serious as in 1983 in terms of the number of farms in the severely distressed category, assuming crop yields in 1985 were at normal levels. Seventeen percent, or 254, of the 1,477 farms would still have zero or negative residual cash flow and 20 percent would have positive cash flows of less than $15,000.

Reducing principal and/or interest payments would enable a number of farmers to work out of their current financial crises, but at high costs to lending institutions and governmental agencies. A five-year moratorium on all principal payments would assist 201 of the severely distressed and 298 of the moderately distressed farmers. Direct average costs per farm to lending institutions for these two groups were estimated at $24,989 and $12,465, respectively, when discounted over the five-year period. The two announced USDA programs—a 25 percent reduction on principal and interest payments for five years for Farmers Home Administration borrowers and a 10 percent write-off on outstanding principal for commercial bank and farm credit system borrowers—would assist a substantial number of farmers. Direct discounted costs per farm for the former program were estimated at $38,065 for the severely distressed group and $27,278 for the moderately distressed group over the five-year period. The latter program would be less expensive with direct costs per farm of $19,584 for the severely distressed group and $14,764 for the moderately distressed group. When summed over all dairy farms in the state that might be eligible for assistance, total program costs to lending institutions could be large. A debt refinancing program at 14 percent over 25 years would have no direct costs, but indirect costs in the form of higher risks to the lender could be substantial.

What are the merits of emergency programs that financially assist farmers? An important negative aspect is that a precedent will be established, resulting in farmers expecting further assistance in the future. Positive aspects include assisting efficient, but highly indebted farmers and enabling lending institutions to recover part of the financial problem loans outstanding. Benefits to lending institutions could be large if the program was offered to those farmers who could show future financial feasibility under limited principal and/or interest payment reductions.

It is widely believed that smaller dairy farmers in Pennsylvania use substantial amounts of off-farm income to subsidize the farm operation. The importance of off-farm income was not considered in this analysis because information was unavailable. In a recent nonrandom sample of 293 dairy farms, 20 percent were found to hold off-farm employment. The amount of off-farm income earned was not known. However, it would be expected this income was being used for family living expenses and debt servicing. If off-farm employment is prevalent, the overall financial position of the severely and moderately distressed farms may not be as serious as that shown in this study. Further research is needed to determine the importance of off-farm income in keeping dairy farms financially liquid.

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ncome Tax Simplification Effects on rop Farm Decision Making

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bstract

e impact of the U.S. Treasury Department's 84 proposed income tax simplification ovisions on crop farm decision making is amined using a dynamic nonlinear timization model. The model incorporates e integrated nature of the firm's production, estment, and financing decisions, and ntrols income tax liabilities as part of the erall optimization problem. The results licate that extending depreciation periods, minating the investment tax credit, and nsolidating tax brackets will result in lower al taxes, increased net worth, increased m investment in land, and decreased estment in machinery.

y words: farm investment, farm taxes, namic optimization.

Changing income tax provisions can have significant long-run impacts on farm firm investment and operating decisions and can be an important determinant of the structure of agriculture. Recently introduced proposals for income tax simplification have raised questions of comparative impacts by industry and economic sector. Analysts have determined that each of the three major tax simplification proposals would reduce the total tax bill of individual taxpayers while increasing the corporate sector's total tax burden. No analysis has been made of the effect of tax simplification proposals on the farm sector.

Previous studies of tax laws and tax law changes (Dean and Carter; Vandeputte and Baker; Lin, Carman, Moore, and Dean; Egington; Reid, Musser, and Martin, 1978 and 1980; Penson, Romain, and Hughes; Carman, 1972 and 1981; Nixon and Richardson; Davenport, Boehlje, and Martin; Richardson, Nixon, and Smith; and Hanson), have demonstrated that the major provisions included in tax simplification can be expected to have long-term impacts on the agricultural sector. The objective of this paper is to analyze the impact of three of the major proposed changes—the collapsed tax rate structure, elimination of the investment tax credit, and the extended depreciation schedules—on crop farm decisions related to land and machinery purchases, land leasing, crop production, and debt. The representative farm approach is used to determine the long-term effects of the revisions on individual farm operators.

Tax Simplification Proposals

The need to simplify the Federal Income Tax Code is gaining widespread acceptance and numerous simplification proposals have been

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advanced. Three proposals that have received serious consideration are the Gephardt-Bradley and Kemp-Kasten bills and the Treasury Department's 1984 proposal. All three proposals provide changes in standard deductions, personal exemptions, and reduce the number of tax brackets to a maximum of three. Following is a brief discussion of the major provisions in each proposal.

The Gephardt-Bradley bill establishes three tax brackets for individual income, beginning at 14 percent. A 12 percent surtax is applied to income above $25,000 for a single taxpayer ($40,000 for a joint return) and an additional 16 percent surtax is placed on income above $37,500 for a single taxpayer ($65,000 for a joint return). The surtaxes apply to gross income, rather than taxable income after deductions. The bill also eliminates the investment tax credit, indexing, and deductions for state and local income taxes, sales taxes, and personal property taxes. It raises the maximum capital gains tax rate from today's 20 percent to 30 percent and extends depreciation schedules similar to those in effect prior to Accelerated Cost Recovery System (ACRS). Heavy farm machinery is depreciated over 10 years with depreciation equal to 25 percent of the declining balance. The Gephardt-Bradley bill lowers the top tax rate on corporate income to 30 percent.

The Kemp-Kasten legislation also eliminates deductions for state and local income taxes and the investment tax credit. It lowers corporate tax rates to a maximum of 30 percent, but it also creates a special rate of 15 percent for companies making less than $50,000 a year. It eliminates the current 16 income brackets with a flat 25 percent tax rate on income, with a partial exclusion on income subject to the Social Security tax. The exclusion is phased out as income rises. The Kemp-Kasten bill retains ACRS. It raises the top tax rate on capital gains to 25 percent but indexes the gains against inflation.

The Treasury Department's 1984 proposal resembles the Gephardt-Bradley bill. It consolidates the tax brackets into three levels. For joint returns, income not exceeding $31,800 is taxed at 15 percent, income between $31,800 and $63,800 is taxed at 25 percent and income in excess of $63,800 is taxed at 35 percent; the brackets are indexed to inflation. It also indexes interest deductions and earnings to inflation. The proposal reduces the top corporate tax rate to 33 percent from 46 percent but it also lengthens depreciation schedules compared to ACRS. Heavy farm machinery is depreciated over 12 years with depreciation equal to 18 percent of the declining balance, but indexed to inflation. It repeals the special treatment of capital gains but adjusts the gains for inflation.

Analytical Model

This study applies a dynamic optimization model to evaluate the impact of tax simplification provisions on farm firms. The use of an optimization model, which is unique for the analysis of agricultural investment response to changing income tax laws, avoids the problems evident in most simulation studies (Egington; Nixon and Richardson; Richardson, Nixon and Smith). Simulation studies are typically forced to rely on rather rigid rules of thumb to determine agricultural investment patterns, even though it has been demonstrated that optimal investment is altered by changes in tax rules (Jorgenson, 1963 and 1967).

The dynamic optimization model used in this study incorporates the integrated nature of the firm's production, investment, and financing decisions. Given a particular set of tax rules, the firm controls the levels of its income tax liabilities as part of its overall optimization problem. All decisions for all time periods are solved simultaneously.

The intertemporal effects of the firm's decisions are evaluated using optimal contro theory. The firm's decisions affect the levels of its stocks, which flow between time periods. Investment in the current period influences both production capacity and tax liabilities in the present and the future. Thus, changes in tax rules have an intertemporal impact on the farm firm; current optimal production, investment, and financing decisions are dependent upon such decisions in the past, as well as upon expectations of future production, investment, and financing opportunities.

The model is deterministic.[1] The firm has an uncertain distant termination date. Its objective criterion is maximization of its net present value. Given a finite time horizon, this is equivalent to maximizing the present value of the firm's net worth in the terminal period where net worth is measured by its assets less its liabilities. As determined by Reid, Musser, and Martin (1978), implicit taxation of a nonliquidating firm's assets in the final period is not required.

Decisions are made in a discrete time frame. For each period, the firm must make decisions concerning crop mix, machinery utilization, land leasing, land purchases and sales, machinery purchases and sales, and refinancing.

Machinery is a major cost component for a typical crop farm. In previous studies, the effect of tax rules on machinery replacement decisions has been evaluated as a separate problem with no consideration of the firm's ability to invest (Smith; Chisholm; Kay and Rister; Bates, Rayner and Custance; and Reid and Bradford). The machinery replacement problem is built-in to the overall optimization problem in this study. The effects of machinery use on machine downtime and repair costs are incorporated in the model.

The model is divided into three principal sectors: the production sector, the tax depreciation sector, and the financial sector. There are flows between sectors and a decision can affect more than one sector.

Crop production occurs in the production sector subject to a specified production technology and production capacity constraints. There are two kinds of stock in the production sector: land and machinery.[2] The land production stock is measured in acres. It is affected by land purchases, sales, and leasing. The machinery production stock represents the number of machinery hours available to perform a particular crop production activity. It is affected by machinery purchases, sales, and use. All such decisions must be distinguished by the vintage of the machine.

The firm's current and previous investment decisions affect its income tax liabilities. The tax depreciation stock measures the remaining amount of depreciation available on the machinery owned by the firm. A portion of this stock flows, according to tax depreciation rules, to provide depreciation deductions from the firm's taxable income. Machinery purchases and sales affect the level of this stock.

The firm has three kinds of financial stock: the market values of its physical assets (land and machinery); debt; and savings. These stocks determine the firm's net worth. The debt stock is affected by decisions concerning land purchases and sales, machinery purchases and sales, and refinancing. Borrowing is restricted by equity requirements. The firm's savings account represents a nonfarm investment opportunity. The change in the savings stock is determined by the net cash flow in each period—net crop revenues plus revenues from land and machinery sales and funds from refinancing, less loan amortization payments, down payments for asset purchases, machinery repair costs, loan payoffs, and tax liabilities.

Model Constraints and Assumptions

The dynamic optimization model is applied to a representative row crop farm located in Yolo County, California, to analyze the long-term effects of income tax simplification provisions. The area has a level topography which facilitates extensive irrigated cultivation of row and orchard crops. The firm's planning period is 1981 through 1988. The objective function value is the present value of the firm's land, machinery, and savings less its debt balances from land and machinery purchases and refinancings.

The discount rates used in the model represent the nominal, after-tax rate of return obtainable on an alternative agricultural investment. The annual discount rates are: 1981, .021; 1982, 0.0; 1983, .063; 1984, .015;

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[1] In a previous study analyzing the impact of the 1981 Tax Act, Hardesty incorporated stochastic crop revenues into a dynamic optimization model using an iterative approach. The results did not differ substantially from those of the deterministic formulation of the problem.

[2] Buildings are omitted from the model because of difficulties in determining building requirements and changes in building capacity. Relative to land and machinery, the role of buildings in row crop production is minor.

and 1985 through 1988, .07. The rates originate from Melichar's findings (1984) and include capital gains from land. The values for 1985 through 1988 are based on the assumption that the annual inflation rate for this period will be five percent and that the agricultural economy will begin to recover. The recovery will be limited, such that real annual returns to agriculture will rise to two percent, lower than the four percent long-term rate determined by Melichar.

The representative farm owns 640 acres; half of the acreage was purchased in 1961 for $800 an acre and financed with a 5.64 percent fixed rate loan and the remainder in 1971 for $1,000 an acre and financed with a 7.86 percent fixed rate loan. This farm size is less than the 933-acre average size in 1982 for farms in the county with sales of $10,000 or more (1982 Census of Agriculture). The farm owns two large crawler tractors, a medium-size combine, and an electronic-eye tomato harvester. All of these machines were purchased in 1976 and financed with a 8.24 percent fixed rate loan. These machine types represent the most costly part of the typical machinery complement for a 640-acre farm in the county (Carter and Johnston). Other machine types are not identified separately because of size constraints on the nonlinear programming problem. The farm has $19,000 in savings, based on the average holdings of financial assets of California farm operators in 1979 (1979 Farm Finance Survey), which were inflated accordingly. At the beginning of the planning problem, the firm's assets are valued at $2,924,667 and its debt to asset ratio is .12, which is representative of established farms in the county.

Cropping alternatives include the major row crops grown in the county—processing tomatoes, field corn, sugar beets, and winter wheat. Institutional marketing practices prohibit the farm from varying its tomato acreage by more than 15 percent in any given year. The farm can lease land on a share-rent basis. Total growth in acreage is limited to 80 acres a year due to the restricted availability of suitable land for expansion.

Five different machine activities are specified in the model. The firm's capacity with respect to these activities depends on the optimal period for performing these activities. The capacity also reflects weather induced delays and machinery downtime; the estimation of the downtime functions is described in Hardesty. The firm has a Leontief production technology. The machinery requirements associated with these activities are based on enterprise budgets (University of California, Cooperative Extension). Machinery requirement constraints specify that the number of machines of a specific type and vintage multiplied by the number of hours the machine is used for an activity, summed over all vintages, equals the machinery requirement per acre multiplied by the number of acres planted of each crop. There are 40 of these nonlinear constraints in the programming model.

Based on actual data, land prices for 1981 through 1983 are $4,300, $4,400, and $4,500 an acre, respectively. In 1984, the price of land dropped sharply to $3,800. It is assumed that the farm income situation begins recovering in 1985. As a result of improved income expectations, land prices rise to match the annual inflation rate of five percent.

The interest rates are based on actual rates for 1981 through 1984. The interest rates on land, operating, and machinery loans from 1985 through 1988 are, respectively: 13, 12.25, 11.5, and 11 percent. The same rates are applicable to refinancings. The interest rate on land loans is variable; it is fixed on machinery loans. Land loans and refinancing are amortized over 30 years and machinery loans have a five-year amortization period. A 25 percent down payment is required on all asset purchases.

Actual machinery prices are used in the model for 1981 through 1984. Between 1985 and 1988, they increase by five percent annually. Used machinery is valued according to the resale price relationships published in the *Agricultural Engineer's Yearbook*.

Revenue from crop production is a function of crop acreages, prices, and yields. Prices and yields are deterministic in the model. Actual county average prices and yields are used for 1981 through 1984. Yields for 1985 through 1988 are held constant at the 1979 through 1983 five-year averages. Output prices for 1985 through 1988 are equal to the 1979–1983 average of real prices (deflated using the Index of Prices Paid by Producers) and applying a five percent inflation rate during the projection period. The firm is assumed to finance and repay 100 percent of its variable operating costs. Operating deficits are covered by withdrawals from savings, sales of assets, and/or financing. Machinery repair costs reduce the firm's cash flow; they are a function of cumulative machine hours as described in Hardesty. Calculating total repair costs requires nonlinear constraints, which contain the product of the number of machines and the cumulative hours on the machines, summed across all vintages.

There is no off-farm income. There are four members in the farm household. Household consumption expenditures remain constant, in real terms, at $19,800 in 1981 dollars, based on USDA's 1973 Farm Operator Family Living Expenditure Survey. This assumption is consistent with the permanent income hypothesis. Consumption withdrawals reduce the farm firm's savings.

Local property taxes, the self-employment tax, and federal and state income taxes are other costs which reduce the firm's net cash flow. The farm firm is assumed to file its income tax returns as a married couple, filing jointly. It claims four exemptions and uses the standard deduction. Deductible expenses include variable operating costs, lease payments, machinery repair costs, interest payments, property taxes, state income taxes, and depreciation; the depreciation is subject to recapture when an asset is sold. There are investment tax credits generated by machinery purchases; these credits are subject to recapture provisions.

There are capital losses associated with the sale of some relatively new machinery. The tax rules require that the net gain or loss from the sale of all such Section 1231 property must be determined; a net gain is treated as a capital gain and a net loss is treated as an ordinary loss. This kind of conditional treatment cannot be modeled; 100 percent of any gain or loss from machinery sales is treated as ordinary income in the model. Similarly, any capital losses from land sales are subject to capital gains treatment in the model, although the tax rules actually allow a limited amount of the losses to offset ordinary income. Taxable income is restricted to be nonnegative to facilitate calculation of the firm's income tax liability.

Five scenarios of the firm's optimization problem are formulated by varying tax rules. Scenario 1, the base scenario, utilizes tax rules in effect on January 1, 1984. All tax provisions in the scenarios are identical with these exceptions: in scenario 2, the investment credit is eliminated; in scenario 3, extended depreciation schedules are used; in scenario 4, the tax rates are changed; and in scenario 5, all of the individual changes from scenarios 2, 3, and 4 are included. The specific tax provisions applied in each scenario are described in the discussion of the scenarios. The relevant tax rules are in effect over the firm's entire planning horizon, 1981 through 1988.

Results

The effects of tax simplification provisions on farm firm decision making are determined by comparing the results of the representative farm's optimization problem under varying sets of tax rules. The optimization problem is solved using MINOS 5.0 (Murtagh and Saunders). MINOS is a state-of-the-art nonlinear programming algorithm. The simplest formulation of the model contains 484 nonlinear variables, 579 linear variables, 48 nonlinear constraints and 717 linear constraints. MINOS does not have an integer programming option; thus, all variables, including machinery purchases and sales, are solved in fractional units. Until further methodological advances are made in nonlinear programming, this potential limitation cannot be addressed. The long-term effects of the varying tax provisions are summarized in table 1.

Scenario 1

Scenario 1 is based on the federal income tax rules in effect as of January 1, 1984. The tax rates, as enacted by the Economic Recovery Tax Act of 1981 (ERTA), are modeled with their phased-in format. The tax brackets are indexed, beginning in 1985. Depreciation deductions are determined in accordance with ACRS, as specified by ERTA and modified by the Tax Equity and Fiscal Responsibility Act of 1982. Thus, the

Table 1. Financial Conditions and Decisions Of Representative Farm By Tax Rule

		Scenarios**				
Measure*	**Initial Period**	**1**	**2**	**3**	**4**	**5**
Firm Net Worth	2,559,336	1,994,192	1,974,246	1,978,905	2,084,196	2,055,672
Land Value	2,688,000	2,313,878	2,286,566	2,254,385	2,047,030	2,437,392
Total Land Purchases	—	286,492	257,404	223,410	0	420,998
Machinery Value	217,667	121,423	96,382	72,258	100,739	62,110
Total Machinery Purchase	—	255,438	209,897	176,946	215,990	81,253
Savings	19,000	81,816	73,806	95,437	266,618	107,160
Total Debt	365,331	385,136	346,356	308,913	207,076	406,612
Debt/Asset	.12	.16	.14	.13	.09	.16
Income Tax Liabilities	—	273,352	321,328	291,910	242,660	253,080
Total Acreage Planted for All Years	—	8,000	8,000	8,000	8,000	7,920

*All dollar values for scenarios 1 through 5 pertain to the terminal period or the entire planning horizon and are expressed in present value terms. Net worth is measured by the market value of all assets less liabilities. Used machinery is valued according to resale price relationships published in the *Agricultural Engineer's Yearbook*.

**Scenario 1 is based on the federal income tax rules in effect as of January 1, 1985.
Scenario 2 is based on the same federal income tax rules as in Scenario 1, except that the investment tax credit is eliminated.
Scenario 3 is based on the same federal income tax rules as in Scenario 1, except that ACRS is replaced by a more extended depreciation schedule as proposed by the treasury.
Scenario 4 is based on the same federal income tax rules as in Scenario 1, except that the tax rates are consolidated into three brackets as proposed by the treasury.
Scenario 5 is based on the same federal income tax rules as in Scenario 1, except that all of the changes in Scenarios 2, 3, and 4 are incorporated.

machinery included in the model is depreciated over five years. Firms have the option of deducting 50 percent of the investment credit from the depreciable basis of an asset or reducing the applicable investment credit rate by two percentage points. The latter option is applied in the model; the investment credit is reduced from 10 percent to eight percent for machinery purchases. No first-year expensing is applied to the machinery expenditures. Sixty percent of any long-term capital gains is excluded from taxation.

The results of the planning problem indicate that the firm's net worth decreases 22 percent over the planning horizon; its annual rates of return are less than the discount factors used in the model. The model perceives excess capacity in the initial stock of machinery (due to the lack of integer restrictions) and sells a portion of this machinery quickly. The firm replaces all of its initial stock of machinery by 1986.

The firm leases increasing amounts of land and purchases new land. Because of the deterministic nature of the model, the firm has the benefit of knowing that land prices decline sharply in 1984. All land purchases occur in 1984 and 1985; they are constrained by the availability of funds for a down payment. No land is sold. The firm's crop production increases by the maximum allowable acreage (80 acres) each year.

Although the firm experiences one year of negative net cash flow, its savings balance more than quadruples, in present value terms, by the terminal period. It does not obtain any equity refinancing. During the planning period, the firm's marginal tax rate fluctuates within the top one-third of the federal tax brackets. The present value of the firm's federal and state income tax liabilities over the planning period totals $273,352. All subsequent scenarios are compared with scenario 1; only relevant differences are noted.

Scenario 2

All assumptions in scenarios 1 and 2 are the same except for the elimination of the investment tax credit in scenario 2. This change causes the firm's net worth in the terminal period to be one percent less than that under the current tax rules (scenario 1). With no investment credit, the firm has less savings for a down payment and buys less and than in scenario 1. The present value of ts machinery purchases is 18 percent less han under the current tax rules. The reduction in machinery purchases is due to the decreased purchasing ability and the ncreased after-tax cost of the expenditures. Because of the reduced land and machinery purchases, the firm's debt balance in the terminal period is 10 percent lower than in scenario 1; and the firm's savings balance is also 10 percent lower. With fewer deductions in scenario 2, the firm's marginal tax brackets in scenario 2 are never lower than those in scenario 1. The present value of all income tax liabilities increases 18 percent with the elimination of the investment tax credit.

The firm's cropping patterns are identical in scenarios 1 and 2 until the terminal period. The variation is due to differences in machinery capacity; however, total acreage planted is the same.

Scenario 3

The only difference among the parameters in scenarios 1 and 3 is the substitution of the Treasury's proposed depreciation schedule in place of ACRS. The Treasury's proposal extends the depreciation period for the machine types identified in the model from five years to 12 years and generates depreciation deductions equal to 18 percent of the declining balance, adjusted for inflation. Although the first year depreciation rate is higher in the Treasury's proposal, the present value of the depreciation deductions under the Treasury's proposal is 15 percent less than the ACRS deductions.

In scenario 3, the firm's net worth is one percent lower than that in scenario 1. The slower depreciation schedule increases the firm's tax liabilities and reduces the funds available for capital expenditures. The present value of the land purchases are 22 percent lower than in scenario 1. The decrease in machinery purchases is even greater—31 percent. Machinery purchases are so unprofitable and/or restricted that the firm continues to operate some of the original machines with high repair costs (tomato harvesters and crawlers) throughout its planning period.

Unlike scenario 1, the firm obtains a small amount of refinancing. This refinancing increases the amount of land purchased by the firm in the following period and generates interest deductions which lower the firm's marginal tax rate in each of the following three years. The firm owes less in scenario 3 than in scenario 1, due to the reductions in land and machinery purchases. The firm has lower deductions in scenario 3 than in scenario 1; its marginal tax brackets in scenario 3 are never lower than those in scenario 1. Although its total tax liabilities are 7 percent higher, the firm's diminished amortization requirements provide a 17 percent increase in savings in the terminal period from the level in scenario 1.

The total acreage farmed is identical in both scenarios 1 and 3. There are minor variations in the crop mix in the final year due to differences in machinery capacity.

Scenario 4

In scenario 4, the tax rates are different from those in scenario 1. The current 16 income brackets are collapsed into three in accordance with the Treasury's proposal. The brackets are indexed to inflation. The values of personal exemptions and the standard deduction are increased as proposed by the Treasury. These changes increase the firm's terminal net worth by five percent.

The revised tax rates reduce the tax savings generated from interest deductions to the extent that the firm does not purchase any land. It purchases 15 percent less machinery in present value terms. Because of the reduced purchases, the firm's debt balance is substantially lower than that under the current tax rules and its savings balance is correspondingly higher. The increased savings are also attributable to an 11 percent decrease in the present value of the firm's total income tax liabilities. In all but two years, the firm is taxed at the highest marginal tax rate.

The firm's cropping decisions are identical in scenarios 1 and 4. All expansion occurs on leased land under the collapsed rate structure.

Scenario 5

The changes in tax rules that are considered individually in scenarios 2, 3, and 4 are all included in scenario 5. The net effect of these revisions is to increase the terminal value of the firm by three percent. Consolidating tax rates increases the funds available for investment. Eliminating the investment tax credit and extending machinery depreciation periods reduce the attractiveness of investing in machinery relative to land. As a consequence, land purchases increase by 47 percent and machinery purchases decrease by 68 percent in present value terms from their respective levels under current tax rules. The firm would have purchased more land if additional funds had been available for a down payment.

Due to the increased land purchases, the firm's debt balance is higher than in scenario 1. However, its savings balance is also higher; this is attributable to the eight percent decrease in the present value of the firm's income tax liabilities. These tax liabilities are four percent higher than those in scenario 4, because of the extended depreciation periods and elimination of the investment tax credit. The firm is in the highest tax bracket in all but one year.

Cropping decisions are identical in scenarios 1 and 5 until the final year. Because machinery purchases are substantially diminished as a result of the combined tax changes, the firm's machinery capacity is reduced to the point that it cannot expand production in the final period. It is more profitable for the firm to have the restricted production capacity rather than change its investment decisions to provide for increased crop production.

Concluding Comments

This analysis examines the impact of major income tax simplification proposals on California crop farms but it is not exhaustive due to model and time limitations. A major revision in the Treasury's proposal concerning elimination of the special treatment of long-term capital gains is not evaluated because the firm does not sell any land. Selling land is not profitable; the proposed revision makes it even less profitable. There are no other activities in the model that yield capital gains. The tax treatment of capital gains income, however, would be an important aspect of a model for a livestock operation. Proposals to change the tax treatment of interest expenses, which could take any of several forms, are not analyzed. Restricting the deductibility of interest will reduce debt financing of investments in land and machinery; the degree of reduction will depend on the form of the restriction. Income tax simplification will have differential impacts by size of farm firm (Hardesty), with the relative impact being a direct function of income level. These differential impacts are a topic for future research as the analytical model is refined.

The provisions included in tax simplification proposals affect both the firm's ability and incentive to invest in land and machinery. Eliminating the investment tax credit and extending the depreciation period for durables resulted in decreased machinery purchases and increased income tax liabilities, as expected. The consolidation of income tax rates into three brackets also resulted in a small decrease in machinery purchases due to reduced tax savings from interest deductions. The most dramatic impact of the new rate structure, taken alone, was to reduce land purchases to zero. Total taxes paid under the new rate structure were also reduced significantly.

Interactions between tax provisions resulted in surprising differences in the firm's decisions when tax changes were considered collectively. Machinery purchases were reduced in each of the scenarios 2 through 4 but the collective impact of all the tax changes was to decrease machinery purchases by 68 percent of those existing in the base model. Land purchases were also reduced from the base in scenarios 2 through 4 (to zero in scenario 4) but increased 47 percent over the base when all of the tax changes were considered simultaneously in scenario 5. The attractiveness of land investments relative to machinery investments increased significantly.

Collectively, the major provisions in the Treasury Department's tax simplification proposal would improve the representative crop farm's net worth, increase both savings and debt for land purchases, and decrease total taxes paid. The combined results of this study indicate that the Treasury Department's proposal would lead to further significant decreases in the demand for farm machinery together with increased pressure for farm expansion and increased demand for farm land. The combined results also indicate the importance of considering a total package of tax law changes in any analytical model. Because of interactions, the impact of separate tax law changes may cancel each other or they may be multiplicative.

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o FmHA Employees Undervalue Land? Test in Indiana

mas E. Atkinson, Deborah J. Brown, and Kim Cook

stract

d value survey respondents differ in iation and job classification from survey urvey. Do these variations bias the survey ılts? A test of the Indiana Land Value vey indicates that an apparent lervaluation of farm land by FmHA ɔloyees and an apparent overvaluation by ıkers disappears when correction is made geographical location.

words: land value survey, contingency le analysis, survey bias.

Land value surveys are conducted by the USDA, the Federal Reserve Bank, and by several states including Indiana. Lending institutions, bankers, attorneys, farm managers, owners, and operators often rely on the results of such surveys in buying, in selling, in financing land sales, in setting land rents, and in determining tax liabilities for estate planning. Therefore it is important that the job or affiliation of the respondents not bias the results of the surveys.

This article describes how contingency table analysis was used to test the 1982 Purdue land value survey for such bias. The technique can be applied without difficulty to other surveys since the test statistic is calculated easily by hand or by using readily available computer packages.

The Survey

Choosing the Sample

The Purdue University rural land values survey has been conducted annually since 1972. The mailing consists of an explanatory cover letter and the questionnaire (see figure 1). Respondents are asked to complete questionnaires for one or more counties in which they work. The principal questions request information about average corn yields, bare land cash rental rates, and land values over a six-month period for top, average, and poor farmland.

Included in the survey sample are representatives of the major farm lenders—banks, Production Credit Associations, the Federal Land Bank (through the Federal Land Bank Associations), the Farmers Home Administration, life insurance companies—and individuals engaged in farm

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Table 1. Categorization of Respondents

	Place of Employment					
Principal Job Function (Total number)	**PCA (78)**	**FLBA (67)**	**FmHA (30)**	**BANK (51)**	**Misc. (38)**	**ROW TOTAL**
Real Estate Broker (6)	0	0	0	0	6	6
Farm Appraiser (7)	0	0	0	0	7	7
Farm Loans (179)	76	66	25	11	1	179
Farm Manager (7)	0	0	0	2	5	7
Banker (31)	2	1	0	28	0	31
Other (2)	0	0	0	0	2	2
Combination (32)	0	0	5	10	17	32
Column Total	78	67	30	51	38	264

management, appraisal, and real estate sales.[1]

Use of Survey Results

The results of the survey are distributed in a number of ways. An article outlining the findings appears in the *Purdue Agricultural Economics Report*, which has a circulation of about 7,000. In addition, reprints of the article are used for classes and conferences held at Purdue, and a number of newspaper and farm magazines publish articles based on the survey results.

Checking for Biases

Given the widespread use of the survey, it is especially important to check for bias. If there were groups within the sample that rated values and yields differently than the rest of the population and these groups were overrepresented among the survey respondents, the survey results would not be a valid representation of the ratings one would obtain from the population as a whole. There was particular concern that respondents with different employment affiliations or job functions might consistently over- or undervalue land.

To test for bias, each of the 278 respondents to the 1982 survey—which had a 50 percent response rate—was classified three ways: place of employment; principal job function within the institution; and geographic region. Table 1 illustrates the breakdowns.

Land value estimates that were considered "high" or "low" were then identified for each of the three land classes.[2] A high land value estimate is defined as one that is above the average estimate of the highest 50 percent of the estimates for that particular land class. A low land value estimate is one that is below the average estimate of the lowest 50 percent of the estimates for that particular land class.

The data were then arranged in two-way contingency tables that classify respondents by these characteristics.

Table 2 is one of the resulting contingency tables. This particular table classifies survey responses by place of employment versus

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[1] With regard to PCA, FLBA, and FmHA, persons working directly with farmers at the local level were the primary contact. In many cases, there was only one person per county representing each of these organizations. Sometimes the same person represented more than one county. Personnel directories were obtained from the FmHA, PCAs, and FLBAs. Bankers surveyed were those who were members of the Indiana Agribankers Association plus a few others who were known to be interested and cooperative. Farm loan representatives of life insurance companies were identified through their membership in the Indiana Chapter of Farm Managers and Rural Appraisers or by personal acquaintance. Names of real estate brokers were obtained from their trade association, the Farm Managers and Rural Appraisers membership list, and personal acquaintance. Additional information about the Purdue Land Value Survey which is conducted annually, can be obtained from J.H. Atkinson, Department of Agricultural Economics, Purdue University.

[2] Bishop, Fienberg, and Holland (1978) discuss techniques for contingency table analysis where some cells have expected values of zero.

Table 2. Place of Employment Versus High and Low Estimates of Land Values—Top Land

Place of Employment	Low[a] Land Value Estimate	High[b] Land Value Estimate	Row Total
PCA	11[c] (15.7)	21 (16.3)	32
FLBA	13 (11.3)	10 (11.7)	23
FmHA	14 (8.3)	3 (8.7)	17
Bank	8 (8.8)	10 (9.2)	18
Misc.	4 (5.9)	8 (6.1)	12
Column Total	50	52	102

Significance, 1.6%.

[a] Low defined as below $854 per acre for poor land, $1,347 per acre for average land, $1,763 per acre for top land.

[b] High defined as below $1,546 per acre for poor land, $2,084 per acre for average land, $2,634 per acre for top land.

[c] The top number in each cell is the number of respondents observed with these characteristics. The number in parentheses in each cell is the number of respondents we would expect to observe if place of employment and land value were independent.

Table 3. Place of Employment Versus Low and High Estimates of Land Values—Average and Poor Land

Place of Employment	Average Land			Poor Land		
	[a]Low	High	Total	Low	High	Total
PCA	14[b] (15.12)	14 (12.85)	28	21 (21.98)	18 (17.02)	39
FLBA	13 (10.26)	6 (8.74)	19	8 (8.45)	7 (6.35)	15
FmHA	14 (9.18)	3 (7.82)	17	13 (9.02)	2 (6.98)	16
Bank	9 (12.42)	14 (10.58)	23	12 (13.53)	12 (10.47)	24
Misc.	4 (7.02)	9 (5.98)	13	8 (9.02)	8 (6.98)	16
Total	54	46	100	62	48	110

Significance, 1.6%.

Significance, 30.4%.

[a] Low and high bids are defined in table 2.

[b] The top number in each cell is the number of respondents observed with these characteristics. The number in parentheses in each cell is the number of respondents we would expect to observe if place of employment and land value were independent.

high and low land value estimates on top land. The top number in each cell in table 2 is the number of observed survey respondents in that category. For example, there are 11 respondents who worked for PCA and had low land value estimates for top land.

The bottom number in parentheses in each cell in table 2 is the number of respondents one would expect to observe in that cell if the categories by which the data have been classified are independent. For example, if employment at PCA is independent of making a low land value estimate, the expected number of respondents in the first cell of table 2 would be 15.7.

The question is whether the differences between observed and expected values are significant—if they indicate that place of employment and a high or low land value estimate are not independent. A chi square (χ^2) test of independence yields a significance level for table 2 of 1.6 percent, indicating that place of employment and high or low land value estimates for top land are not independent at a significance level of 1.6 percent.[3]

Table 3 shows contingency tables of place of employment versus estimated land values for average and poor land. χ^2 tests here indicate that place of employment and land value estimates are not independent at the five percent significance level for average land either, although they are independent for poor land.

The χ^2 significance tests are for the contingency table as a whole. Individual cells in the table can be examined, however, to determine which contributed the most to the χ^2 statistic, in other words, which groups tended to have unexpectedly low or high estimates. In the case of employment and land values, PCA employees tended to make noticeably fewer low estimates and more high estimates on top land than one would expect to observe if place of employment and land value estimates were independent. Similarly bank employees tended to make noticeably fewer low and more high estimates on average land than one would expect. FmHA employees tended to make both more low and fewer high estimates on all land classes. This last result—very noticeable and crossing all land classes—is particularly worrisome as an indication of possible survey bias.

Before concluding however that FmHA employees undervalue land, the authors examined the possibility that the group's geographic location was causing this variation. Perhaps a disproportionate number of FmHA respondents were located in

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[3] The test statistic, which is distributed χ^2 with (R-1)(C-1) degrees of freedom, is

$$Q = \sum_{i=1}^{R} \sum_{j=1}^{C} \frac{(N_{ij} - E_{ij})^2}{E_{ij}}$$

where there are R rows and C columns in the contingency table, N_{ij} is the observed value in the cell of row i, column j, and E_{ij} is the expected value—assuming independence—in the cell of row i, column j. The expected value is calculated as

$$E_{ij} = \frac{N_i \cdot N_j}{n}$$

where N_i is the sum of the observed values in the cells of row i, and N_j is the sum of the observed values in the cells of column j, and n is the number of respondents. These calculations are described in numerous statistical texts. See, for example, DeGroot (1975).

Table 4. Place of Employment Versus High and Low Estimates of Land Values in Southeastern Indiana

Place of Employment	Top Land			Average Land			Poor Land		
	Low[a]	High[b]	Total	Low	High	Total	Low	High	Total
FmHA	3[c] (1.8)	0 (1.2)	3	7 (14.7)	0 (2.3)	7	7 (5.5)	0 (1.5)	7
Other	4 (5.2)	5 (3.8)	9	7 (9.3)	7 (4.7)	14	8 (9.5)	4 (2.5)	12
Total	7	5	12	14	7	21	15	4	19

Significance, 15.9%.

Significance, 7.2%.

Significance, 12.8%.

[a] Low defined as below \$600 per acre for poor land, \$947 per acre for average land, \$1,302 per acre for top land.

[b] High defined as above \$1,011 per acre for poor land, \$1,587 per acre for average land, \$2,011 per acre for top land.

[c] The top number in each cell is the number of respondents observed with these characteristics. The number in parentheses in each cell is the number of respondents we would expect to observe if place of employment and land value were independent.

counties with inferior farm land.

As a first test of this possibility, a list of the counties for which FmHA personnel estimated low values was obtained, and the average Census of Agriculture land value for hese counties was calculated. The resulting figure is 32 percent below the census's statewide land value average, indicating that FmHA employees were located in counties with lower than average land quality.

This first test is not altogether satisfactory however, because Smith and Raup have shown that in Minnesota the 1974 and 1978 Census of Agriculture tended to overvalue poor land and undervalue good land. Such a bias could be the effect of differing responses by farmers to changing land prices, with farmers on poor land slower than the others to respond to changes. Since prices were rising when Smith and Raup made their study, but decreasing when the 1982 Indiana land survey was made, it is not clear what the direction of any bias in the agricultural census land values might be. A second test was therefore performed on the data from a section of Indiana which has

Table 5. Job Function Versus Low and High Estimates of Land Values

Job Function	Top Land			Average Land			Poor Land		
	[a]Low	High	Total	Low	High	Total	Low	High	Total
Real Estate Broker	0[b] (.99)	2 (1.01)	2	0 (1.08)	2 (.92)	2	2 (1.66)	1 (1.34)	3
Farm Appraiser	1 (2.48)	4 (2.52)	5	1 (3.23)	5 (2.77)	6	1 (3.31)	5 (2.69)	6
Farm Loans	37 (35.66)	35 (36.34)	72	41 (34.46)	23 (29.54)	64	44 (39.72)	28 (32.28)	72
Farm Manager	0 (.50)	1 (.50)	1	0 (1.08)	2 (.92)	2	0 (1.10)	2 (.90)	2
Banker	4 (5.94)	8 (2.06)	12	3 (7.54)	11 (6.46)	14	4 (6.62)	8 (5.38)	12
Combination	10 (6.44)	3 (6.56)	13	11 (8.08)	4 (6.92)	15	13 (11.03)	7 (8.97)	20
Total	52	53	105	56	48	104	64	52	116
	Significance, 7.7%.			Significance, 0.2%.			Significance, 7.2%.		

[a] Low and high bids are defined in table 2.

[b] The top number in each cell is the number of respondents observed with these characteristics. The number in parentheses in each cell is the number of respondents we would expect to observe if job function and land value were independent.

Table 6. Job Function Versus High and Low Estimates of Land Values in West Central Indiana

Place of Employment	Top Land			Average Land			Poor Land		
	Low[a]	High[b]	Total	Low	High	Total	Low	High	Total
Banks	3[c] (3.4)	3 (2.6)	6	4 (3.1)	3 (3.9)	7	4 (2.5)	2 (3.5)	6
Other	9 (8.6)	6 (6.4)	15	3 (3.9)	6 (5.1)	9	7 (4.5)	10 (6.5)	11
Total	12	9	21	7	9	16	7	10	17
	*Significance, 100%.			Significance, 32.9%.			Significance, 14.5%.		

[a] Low defined as below $1,010 per acre for poor land, $1,520 per acre for average land, $1,963 per acre for top land.

[b] High defined as above $1,756 per acre for poor land, $2,226 per acre for average land, $2,690 per acre for top land.

[c] The top number in each cell is the number of respondents observed with these characteristics. The number in parentheses in each cell is the number of respondents we would expect to observe if job function and land value were independent.

*A Two by Two Table can be calculated by Fisher's Exact Test.

generally poorer quality land (southeastern Indiana). Table 4 gives the results of this test. The table shows that although FmHA employees in southeastern Indiana had more low and fewer high land value estimates than other survey respondents, the difference was not significant at a five percent level. It would appear that the FmHA personnel who had "underestimated" land values were justified in doing so because of their geographic distribution in regions of poor quality farmland.

A similar analysis was performed on contingency tables of job function versus low and high land value estimates. The results are shown in table 5. Bankers were found to have noticeably more high and fewer low value estimates over the three land classes. As in the case of place of employment a geographic comparison using agricultural census figures was used to determine if the bankers were "justified" in their high estimates. The specific counties from which their overestimates came had an average land value 15 percent higher than the statewide average.

Since the direction of possible bias from the agricultural census data was unknown, a second test was performed on the data from a section with generally higher land quality (west central Indiana). The results are shown in table 6. The table shows that there was no significant difference between bankers and other respondents in the number of high land values in this high land value region. Again we can state with reasonable assurance that the bankers were justified in reporting a larger than expected number of high estimates.

It therefore appears that at least in one land value survey, estimates of land value are independent of place of employment and job function once geographical differences are considered.

Conclusion

This paper describes the use of a technique for checking a land value survey for bias. The example used is the 1982 Purdue Land Value Survey. The technique is contingency table analysis. The analysis indicated that, in this survey, neither place of employment nor job function significantly affected estimates of land value once geographical differences were considered.

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Figure 1. The Questionnaire

Please return by July 1, 1982 to:
Dr. J. H. Atkinson
Dept. of Ag. Econ.
Purdue University
West Lafayette, IN 47907

NAME: ____________________

ADDRESS: ____________________

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CROPLAND VALUES AND CASH RENTS—1982

The following data on farm real estate values are for:

1. ____________________ County

2. My job is primarily that of: a. ______ real estate broker, b. ______ farm appraiser, c. ______ farm loans, d. ______ farm manager, e. ______ banker, f. ______ other

3. In the table below, please give your estimate per acre of (1) long-term average yields, (2) the market value of *bare cropland* in December 1981, June 1982, and your guess for December 1982, (3) the market value of land which is moving into nonagricultural uses, and (4) bare cropland cash rent for 1982.

Quality of Farmland	**Average Corn Yield Bu/A**[a]	**December 1981**	**June 1982**	**December 1982**	**1982 Land Cash Rent/Acre**
Top	______a/	$______	$______	$______	$______/
Average	______a/	$______	$______	$______	$______/
Poor	______a/	$______	$______	$______	$______/
Transition[b] Land		$______	$______	$______	

[a] Long-term average corn yields with typical farming practices.

[b] Areas where much of the land is moving into residential, commercial, and industrial use.

4. What is your estimate of the annual average on-farm corn and bean prices, farm mortgage interest rates, and inflation rates for the five-year period 1982–1986?

#2 Corn: $______ per bushel   Soybeans: $______ per bushel

Mortgage interest rate ______   Inflation rate ______

5. From current levels, where do you expect land prices to be five years from now? (Check and give percentage estimate where appropriate.)

______Up, by ______%   ______No change   ______Down, by ______%

6. What changes are taking place in leasing arrangements as a result of the "financial squeeze" in farming? Use back of page if necessary.

A Linear Programming Analysis of the Regulatory Response of Rural Banks in the Philippines

Donald W. Larson, Severino B. Vergara, and Warren F. Lee

Abstract

The Philippine government through the Central Bank has tried to influence the rural banks' allocation of funds in favor of small farmer loans through changes in regulatory policy. A linear programming model was developed to evaluate changes in the small farm loan portfolio resulting from selected regulatory changes. Results indicate that neither seed funds to support supervised credit programs nor preferential interest rates on rediscounted funds for agricultural loans increase the flow of credit to small farmers. Such policies increase bank profits, discourage banks from mobilizing local deposits, and increase their dependence on Central Bank rediscount funds.

Key words: Philippines, small-farmer credit, rural banks, linear programming.

An increase in the supply of institutional credit to the agricultural sector, particularly the food sector which is dominated by the small farmers, has been one of the policy objectives of the Philippine government to achieve increased agricultural productivity and more equitable income distribution during the last two and a half decades. The most well known of these programs is the Masagana 99 (M99) program launched in 1973 to achieve self-sufficiency in rice production. M99 integrated under one umbrella low cost production credit as a vehicle for income transfers to small rice farmers, a fertilizer subsidy, price support, technical assistance, and other agricultural support services (Esguerra). In addition, the government, through the Central Bank (CB), initiated the development of the rural banking system. The CB provided tremendous technical and financial support to ensure the viability and success of the rural banks. At the same time, it has tried to influence the rural banks' allocation of funds in favor of small farmer loans through changes in the regulatory policies. No previous study has been conducted to analyze the effects of those policies on the allocative behavior of banks.

The objectives of the present study are: (a) to determine the profit-maximizing level of small farm loans of a representative rural bank, given the available alternative assets, internal operating constraints, regulatory policies of the CB, and other external constraints, and (b) to evaluate the changes in the small farm loan portfolio of a representative rural bank resulting from changes in selected regulatory policies.

Donald W. Larson is a professor, Severino B. Vergara is a former graduate student, and Warren F. Lee is a professor in the Department of Agricultural Economics and Rural Sociology at The Ohio State University. The authors express their appreciation to three anonymous journal reviewers for helpful comments.

The Analytical Approach of the Study

Linear programming (LP) is the analytical approach employed to achieve the objectives of this study. The assumption of profit maximization for the bank and the linearity of all the constraints facing the bank suggest the suitability of the LP technique for the present study. A multiperiod model is used to avoid suboptimal decisions which might result from a myopic view that ignores the relevant aspects of the future. The bank is assumed to have a one-year planning horizon that is partitioned into 12 monthly planning periods. The choice of the monthly planning periods was dictated in large part by the fact that rural banks are required by the CB to submit monthly financial statements used to determine compliance with the regulatory constraints imposed on them. These constraints are discussed in the next section of this paper.

The general form of the LP model estimated in this study is:

$$\text{Maximize } \pi = \sum_{t=1}^{12} \left(\sum_{i} r_i A_{i,t} + \sum_{j} C_j L_j L_{j,t} + FC_t \right)$$

$$\text{subject to:} \quad R_{kt} \left(A_{i,t} - L_{j,t} \right) \leq \beta_{kt}$$

where π=expected net profit during the planning horizon.

r_i=expected net return on asset i.

C_j=expected cost of liability j.

$A_{i,t}$ $L_{j,t}$=average stock of asset i and liability j, respectively, during period t.

R_{kt}=coefficient matrix for individual asset and liability accounts associated with constraints K at time t. ($K = 1, ...n$;
n = number of constraints).

β_{kt}=vector of stipulations associated with constraints k at time t.

FC_t=fixed costs at time t.

As formulated above, the objective function used is the maximization of the monthly flows of net profit or income. This is equivalent to the maximization of the return on stockholders' equity (ROE) at the start of the planning period since it is assumed that there is no capital expansion through the sale of new shares of stock; i.e., reinvestment of profits is the only source of additional capital in the model.

The model is not meant to accurately describe the detailed behavior of the banks; nor is it intended to generate results needed in the day-to-day decision making of the bank managers. Rather, it is an analysis of the effects of changes in specific regulations on the balance sheet choices of the banks. This study attempts to simulate the actions of a bank manager who does not use sophisticated models for choosing the portfolio. Thus, it seems reasonable that a model including only the kind of knowledge and expectations a manager might have would be preferred over more complicated models.

While profit maximization is the goal assumed in this study, it does not mean that it is the only goal pursued by the firm. Bank firms in fact, are assumed to have other goals but with profit maximization as the dominant goal. In a sense, the other goals act as constraints to profit maximization. A liquidity goal and the maintenance of a certain-level-of-risk goal are just some of the other legitimate goals of the bank. This recognition of multiple goals for the banking firm has led some researchers to suggest a goal or lexicographic programming approach to study bank behavior (Keown). The difficulty with this approach is that it requires specification of the priority-weighting structure among the different goals identified in the model, a task which could very well form a separate study in itself.

As Cohen and Hammer report, there are alternative choices for consideration in the specification of the objective function to use in a bank behavior model: (a) maximize the value of the stockholder's equity during the final period of the planning horizon; (b) maximize the present value of the net income stream plus realized capital gains (and losses) during the planning horizon; and (c) maximize the present values of the net income stream plus realized capital gains (and losses) during the planning horizon plus the present value of the stockholders' equity during the final period of the planning horizon. Obviously, these choices are more appropriate for banks whose capital stocks are being traded in the stock market, as in the case of large commercial banks. This is not the case, however, for rural banks in the Philippines. These banks are closely held corporations and although the sale of new stocks and stock transfers is allowed, these transactions are regulated by the CB. In practice, a majority of the stock transfers and new stock sales are transacted among the existing stockholders and their familiies.

In contrast to the above specifications of the objective function which are in terms of present value, the objective function for the rural banks in our model is in terms of current values. For a one-year planning horizon the differences between discounted and nondiscounted values would be slight, so that the use of nondiscounted values may slightly overstate profits. Except for medium and long-term loans which account for a very small share of Philippine rural bank loan portfolios, all the asset activities in the model have maturities of less than one year. Also, interest income is assumed to be deducted in advance for all loans. Hence, the problem introduced by not using present value originates mainly from the differences in the monthly repayment flows among the loan variables.

The Constraints in the LP Model

The profit-maximizing goal of the bank is restricted by three categories of constraints: those imposed on it by the regulatory authorities, the *regulatory constraints;* those that are related to the market, the *market constraint;* and a *funds-availability constraint* used merely to specify that total uses of funds equal total funds available.

Regulatory Constraint[1]

Reserve requirement. The required reserve is 14 percent for demand deposits and eight percent for time and savings deposits. At least 10 percent of the total required reserves must be in the form of cash deposited with the CB. The balance of the required reserves may be held in the form of vault cash and/or CB-supported securities. However, holding securities eligible as reserves cannot exceed 18 percent of the total required reserves (or 20 percent of the maximum 90 percent allowable reserves held in the form of CB-supported securities and/or vault cash).

Risk-to-asset ratio. By regulation, a rural bank must maintain a risk-to-asset ratio of not less than 10 percent. This ratio is computed by dividing total assets less risk-free assets by capital funds. Risk-free assets include cash on hand and due from banks, CB-supported securities, loans secured by deposits, bank premises, furniture, fixtures and equipment, and supervised credit loans covered by guarantee.

Operating capital ratio. The bank's operating capital (cash on hand plus the amounts due from the CB and from other banks) must be less than or equal to 40 percent of total deposit liabilities (exclusive of special deposits). This requires that the bank reduce its own liquid assets to this level before borrowing from the CB.

Past-due loan ratio. The ratio of past-due loans to the total loans outstanding of the bank cannot exceed 25 percent if the bank is to avail itself of the special rediscounting privilege with the CB as well as other privileges. Excluded from past-due computation are loans covered by guarantee and M-99 loans in litigation (since M-99 loans are most likely to be covered by guarantee, guaranteed loans must be excluded to avoid double counting.)

Rediscounting constraints. There are two separate ceilings on the amount of loans that rural banks can rediscount with the CB. The ceiling depends on whether or not the loans are supervised. For supervised loans, the rediscounting limit is 400 percent of net worth plus 100 percent of monthly average savings and time deposits (STD) during the three months immediately preceding the date of rediscount application. The corresponding figures for nonsupervised loans are 200 percent of net worth plus 50 percent of monthly average STD. All of the outstanding balances of supervised loans can be rediscounted with the CB, but only 80 percent of nonsupervised loans can be discounted. Only loans with original maturities of less than one year are rediscountable.

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[1] The bank-premises ratio and the furniture, fixture, and equipment ratio were not included in the model but are a part of the total assets. It was assumed that there will be no purchase and sale of these assets during the programming period.

Market Constraints

Loans. In the context of rural financial markets in the Philippines, interest rate ceilings on loans are set by the CB and typically these rates have been less than the annual rate of inflation. The low, even negative, real rates of interest on these loans lead to an excess loan demand from potential borrowers and credit rationing by lenders (Adams). Regulators attempt to influence rural bank lending by changing the spread between the fixed lending rate and the bank's cost of funds. In the model it is assumed that the bank will not lend more than is forecast in any loan category during any period. This implies that there is no incentive for banks to compete for loans in general. However, for certain loans, specifically those with low default risks, some degree of competition may be present depending on the structure of the market. Therefore, the forecast should be linked to a certain level of loan risk. Beyond this forecast, the bank is restricted by risk considerations from further lending, and hence, will simply say "no" to particular loan requests. There is a real need to specify the market limits on the loans in the model. Since it is likely that net rates of return among types of loans would differ, the model operates such that, ceteris paribus, all the available funds will be channeled into loans offering the highest return. Loan demand forecasts were based on the amounts granted by the bank in the previous year with a 20 percent upward adjustment for the expected rate of inflation and additional increases in real loan demand.

Investments. Except for equity investments, there are no market constraints on the amount of new investments a bank can make during each period. It is assumed that the supply of government securities and money market instruments is infinitely elastic. Equity investments are regulated very strictly by the CB and for our purposes they can be assumed to be zero. Of course, the reduction or sale of investment assets is constrained by the initial amount available.

Deposit variables. As in the case of loans the increase in deposit variables is limited to the forecast levels during the period. The variables are measured in terms of net monthly balance so there is no need to include another set of variables to represent withdrawals, new accounts, interest credits, and so forth, in the model. Intertemporal relationships are of prime importance in a multiperiod model since they express the interdependence of variables over time. This is particularly true with respect to the maturity of the accounts, and hence, the associated liquidity flows. In addition to maturity flows, an autonomous flow variable is associated with each account at each time period. When the flow is positive, the account is accumulating; when the flow is negative, the account is being depleted. Asset and liability flows are assumed to take place at constant rates during the period. Under this assumption, purchases, sales, and maturations of assets are presumed to occur at constant rates during the period and hence the rate of change in the stocks of the balance sheet accounts themselves will be constant over time. The advantage of this assumption is that the average stock of an account during a period can be defined simply as the arithmetic mean of the initial balance and the end-of-period balance.

Default risks on each loan are assumed to be independent, and default risks across types of loans are also assumed independent. Although this assumption may be somewhat implausible for borrowers in the same industry, it is necessary for the independence of coefficients and constraints in the model. Default risk on the bank's investment portfolio, primarily national government bonds and Central Bank Certificates of Indebtedness, is assumed to be zero.

Determination and Selection of Sample Banks

This study was limited to banks operating in the Central Luzon region of the Philippines. A large proportion of the small farmers in the country are located in this region, and it has been a hotbed of social and political unrest in the country. The economic plight of the small farmers in this region has consistently been accorded top priority in the government's agricultural development programs. Since the analytical thrust of the study is the identification of changes in CB policies needed to influence rural bank credit allocation in favor of the small farmers, the choice of this region as the study area is logical.

A random sample of 15 rural banks was included in the study. This constitutes over 10 percent of the rural bank population in the region (exclusive of those banks less than three-years old). After distributing the number of banks to be sampled among the six provinces in the region, in proportion to the number of rural banks operating for more than three years, the CB Agricultural Credit Supervisors (ACS) were instructed to select randomly the banks to be included in the sample. Because of the confidentiality of bank information, the selection of sample banks had to be done by the ACS assigned to the region; however, the sample selection was carefully designed and personally supervised by the researcher. One condition made in the sample selection was that the selected banks should have assets of no more than P30 million nor less than P4 million to prevent extremely small and large banks from introducing significant bias in the sample.[2] Data needed for the LP model were gathered through the use of a structured and pretested questionnaire.

In terms of total assets, the average size of the 15 sample banks covered in the study was P10,404,207 as of October 31, 1979 (table 1). The size varies from P4,194,084 to P22,108,270 with a standard deviation of P4,861,233. The banks are distributed with eight banks above the average, seven below it, and 10 of the 15 are within one standard deviation of the mean. The average sample bank has 84 percent of its total assets in loans, 89 percent of which are agricultural. Deposit liabilities constitute 38 percent of the total liabilities (including capital) of the average sample bank. Borrowings from the CB account for 36 percent of the total liabilities, almost 89 percent of which is in the form of rediscounting. The total capital accounts of the average sample bank is P1,171,787, about 11 percent of total assets. The total capital account for 11 of the 15 banks is within one standard deviation of the mean. More than 45 percent of the capital is in common stocks and almost 52 percent is in undivided profits and surplus accounts. Preferred stocks account for the balance.

Table 2 shows the expected net returns on assets and the total cost of liabilities of the sample rural banks, including the estimated administrative costs of different classes of assets and liabilities and the risk of default losses of different classes of assets. Small supervised agricultural loans (SSL) have administrative costs of 1.56 percent, followed closely by small ordinary agricultural loans (SOL), 1.54 percent. Large supervised (LSL) and large ordinary agricultural loans (LOAL) involve much lower administrative costs, 0.98 percent and 0.96 percent, respectively. Medium- and long-term agricultural loans (MLL) have the highest estimated default risk, 4.3 percent, followed by SSL at 3.3 percent. The default risk associated with each type of loan was based on the bank management's estimate of default, the type of security required on loans, and an analysis o past-due loans by type for each bank.

Results

The LP bank model was solved using the average balance sheet conditions of the sample banks as of October 31, 1979. Three versions of the basic model were also solved to evaluate the impact of changes in the regulatory policies. The first version incorporated a parameterized increase of 50 percent over the original loan demands used in the basic model to deal with the uncertainties associated with the demand forecasts.[3] The second version analyzed the impact of the suspension of special time deposits as a seed fund to support the supervised credit program of the rural banks. The third version examined how equalizing the interest rates on rediscount funds for supervised agricultural loans and ordinary agricultural loans (one percent and three

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[2] The exchange rate in October of 1979 was about P9.50 per U.S. dollar.

[3] The loan demand forecasts have been parameterized in such a way that they cover increases of 10 percent, 20 percent, 30 percent, 40 percent, and 50 percent over the original. However, the solution values do not differ much between 10 percent and 40 percent and hence only the results for 50 percent are presented.

Table 1. The Average Balance Sheet Characteristics of the 15 Sample Rural Banks as of October 31, 1979, Central Luzon, the Philippines

Assets	
Cash and Due from Banks:	
Cash on Hand (CH$_0$)[a]	P 106,424
Due from CB (CC$_0$)	98,996
Due from other banks (COB$_0$)	687,534
	892,955
Loans and Discounts	
Small supervised agricultural loans (SSL$_0$)	2,015,608
Small ordinary agriculture loan (SOL$_0$)	1,038,108
Large supervised agriculture loan (LSL$_0$)	2,511,297
Large ordinary agriculture loan (LOAL$_0$)	1,887,502
Medium- and long-term agriculture loan (MLL$_0$)	370,597
Commercial loan (COM$_0$)	524,392
Industrial loan (INL$_0$)	249,107
Other loan (OL$_0$)	164,933
Less: Allowance for probable losses	(238,455)
Net Loans and Discounts	8,523,090
Investments:	
CB Certificate of Indebtedness	
reserve eligible (ERES$_0$)	56,486
nonreserve eligible (XRES$_0$)	89,527
Preferred stock redemption (PSR$_0$)	8,110
Agrarian Reform Credits (ARC$_0$)	35,881
Other Assets:	
Bank premises (BPREM)	156,265
Furniture, fixtures, and equipment (FFE)	79,990
Other bank assets (OBNA)	
Total Assets	P 10,404,207
Liabilities:	
Reserve Deposits:	
Demand deposits (DD$_0$)	7,748
Savings deposits (SD$_0$)	2,327,666
Time deposits (TD$_0$)	1,581,454
Nonreserve Deposits:	
Special time deposits (STD$_0$)	712,294
Barrio Guarantee Fund (BGF$_0$)	21,715
Barrio Savings Fund (BSF$_0$)	78,769
Special Savings Deposits (SSDC$_0$)	95,269
Bills Payable:	
Rediscounting-supervised (RED$_0$)	2,783,228
Rediscounting-ordinary (REDO$_0$)	570,499
CB-IBRD (IBRD$_0$)	361,832
Other Bills Payable (OBIL)[b]	71,018
Other Liabilities (OLIAB$_0$)	620,921
Capital Accounts (CAP$_0$)	1,171,787
Total Liabilities[c]	P 10,404,207

Source: Vergara

[a] The subscript of zero (0) indicates that the figure opposite the balance sheet variable serves as the initial value of these variables during the first programming period.

[b] Restructured borrowings from the CB

[c] The exchange rate in October of 1979 was about P9.50 per U.S. dollar.

percent, respectively) with that on commercial and industrial loans (four percent), affected the allocation of funds among different types of loans. Due to the size and complexity of the model, table 3 contains results only for selected variables pertinent to this study, and only year-end balances or total yearly results are included. Monthly and yearly results were calculated for a total of 65 variables (Vergara).

All the results from the basic model are as expected, given the constraints imposed and the relative returns and costs of the various asset and liability variables. They are also consistent with the profit-maximizing goal of the bank. The results cannot be expected to correspond exactly with the actual balance sheet composition of the rural banks operating under real world conditions; however, the substantive results from the model and their implications are plausible under real world conditions.

A gross profit of P422,220 was obtained from the basic model. Adjusting this for the other operating expenses and other income throughout the 12 programming periods resulted in actual net profit (P) of P213,177 (table 3). This represents the sum of all the

Table 2. The Expected Net Returns on Assets and the Total Costs of Liabilities of the Sample Rural Banks, Central Luzon, the Philippines, November 1979-October 1980

Items[a]		Nominal Return (1)	Service Charge (2)	Administrative Cost[b] (3)	Risk of Default Loss (4)	Net Return[c] (Total Cost) (5)
				Percent per annum		
Assets						
	SSL	10.71	2.00	1.56	3.32	7.83
	LSL	10.71	2.00	.98	2.85	8.88
	SOL	10.71	3.00	1.54	2.38	9.79
	LOAL	10.71	3.00	.96	2.79	9.96
	MLL	12.50	3.00	1.91	4.36	9.23
	COML	10.71	3.00	2.47	3.14	8.10
	INL	10.71	3.00	1.52	.68	11.51
	OL	10.71	3.00	0.00	.94	12.77
	CCB	3.0	0.00	0.00	0.00	3.00
	XRES	3.0	0.00	0.00	0.00	3.00
	ERES	10.32[d]	0.00	0.00	0.00	10.23
	PSR	10.32	0.00	0.00	0.00	10.23
	ARC	10.32	0.00	0.00	0.00	10.23
Liabilities						
	SD	9.50		1.00		10.50
	TD	13.50		.59		14.09
	STD	3.00		.25		3.25
	BGF	9.50		1.41		10.91
	BSF	0.50		.46		9.96
	SSDC	0.0		1.27		1.27
	REDS	1.0		.35		1.35
	REDO	3.0[e]		.99		3.99
	IBRD	9.0		.58		9.58
	OBIL	0.0		1.53		1.53
	OLIAB	0.0		.20		.20

Source: Vergara

[a] See table 1 for a definition of the variables.

[b] Only direct costs were included in estimating the administrative costs of the balance sheet items in the model. This includes salaries and compensation expense and litigation and asset acquisition expense. These expenses were allocated in proportion to the time spent by bank personnel on each of the classes of assets and liabilities. Depreciation and overhead costs are treated as fixed costs in the model. The latter affect the size of the loan portfolio but not its composition.

[c] Net return on asset equals (1 + 2) − (3 + 4) and total cost of liability equals 1 + 3.

[d] The computed average rate of return on securities is 9.875 percent per annum. Since the return is tax-exempt and the average bank is at a 4.31 percent tax bracket, the before-tax return equals 10.34 percent.

[e] The rediscount interest rate on commercial and industrial papers is four percent per year.

Table 3. Optimal Solution Values of the Structural Variables in the Basic Rural Bank LP Model and Three Alternative Versions, Central Luzon, Philippines, 1980

			Version No. 1		**Version No. 2**		**Version No. 3**	
	Base Model		**A 50% Increase in Loan Demand**		**Elimination of Special Time Deposit Seed Fund**		**Equalization of Interest Rates on Rediscount Funds**	
Variables[a]	**Period 12**	**Total**	**Period 12**	**Total**	**Period 12**	**Total**	**Period 12**	**Total**
			---------- P 000 ----------					
ICCB							217.4	
CCB	807.5		783.4		783.4		1,000.7	
COB		2,398.6						
SSLC	145.5		218.2	3,747.9	145.5	2,197.6	145.5	
SSL	1,919.7		2,694.1		1,900.3		1,919.7	
SOLC	67.4	1,180.7	101.1	1,771.0	67.4	1,180.7	67.4	1,180.7
SOL	1,003.5		1,441.9		1,003.5		1,003.5	
LSLC	196.1	3,436.6	294.2	5,154.9	196.1	3,436.6	196.1	3,436.6
LSL	2,854.2		4,010.5		2,854.2		2,854.2	
LOLC	128.9	2,259.1	193.4	3,388.7	128.9	2,259.1	128.9	2,259.1
LOAL	2,065.1		2,925.7		2,065.1		2,065.1	
MLLC	39.7	476.6	39.7	476.6	39.7	476.6	39.7	476.6
MLL	847.2		847.2		847.2		847.2	
COMLC	81.5	978.6	81.5	978.6	81.5	978.6	81.5	978.6
COML	608.5		608.5		607.1		608.5	
INLC	46.1	553.4	46.1	553.4	46.1	553.4	46.1	553.4
INL	429.9		429.9		429.9		429.9	
OLC	29.5	345.9	29.5	345.9	29.5	345.9	29.5	345.9
OL	242.1		242.1		242.1		242.1	
XRESC	111.9		43.4		69.3			
XRES	111.9		43.4		654.0			
ERES	56.5		56.5		56.5		56.5	
ARC	997.0		1,320.00		994.9		997.0	
SDC	34.4	355.4	34.4	355.4	34.4	355.4	34.4	355.4
SD	2,683.0		2,683.0		2,683.0		2,683.0	
TDC	74.7	512.4	74.7	512.4	74.7	512.4	74.7	512.4
TD	1,226.1		1,226.1		1,226.1		1,226.1	
BGFC	0.7		0.7		0.7		0.7	
BGF	7.5		7.5		8.2		7.5	
BSF	78.8		78.8		78.8		78.8	
SSDC	157.1		235.7		157.1		157.1	
SREDSC		2,352.1		3,527.6		2,052.1		2,143.3
SREDS	1,316.5		1,974.8					
LREDSC		3,240.5		4,860.7		3,240.5		3,118.9
LREDS	2,000.7		3,001.1					
SREDOC		425.7		1,046.6		511.9		
SREDO	135.4		611.1					
LREDOC		612.7		1,488.4		998.2	776.8	
LREDO	57.1		655.1					
CREDOC		167.9		260.9		256.7	260.9	
IREDOC		73.8		119.9		184.4	147.6	
IBRDC	35.3	423.7	35.3	423.7	35.3	423.7	35.3	423.7
IBRD	569.0		569.0		569.0		569.0	
OLIABC	41.9	404.6	42.0		42.0		42.0	404.6
OLIAB	1,025.5		1,025.5		1,025.5		1,025.5	
UI	394.7		546.8		394.7		394.7	
APL	387.4		380.4		286.7		287.4	
P	16.6	213.1	37.3	363.8	15.7	178.6	15.4	157.7
CAP	1,384.9		1,536.1		1,350.4		1,329.5	

Source: Vergara

[a] See table 4 for definition of variables.

period net profits and translates into an optimal return on equity (ROE) to stockholders of 16.68 percent. The average ROE for the 15 rural banks was 22 percent in the previous year.

The model solution values for the liquid asset variables—cash on hand (COH), due from Central Bank (CCB), and due from other banks (COB)—remained relatively constant throughout the year at P783,374. The liquid assets represent exactly 20 percent of the deposit liabilities with required reserves—savings deposits (SD), time deposits (TD), and demand deposits (DD). This percentage exactly matches the recommended primary reserves ratio of 20 percent that was imposed on the model. An optimal total year-end loan portfolio amounting to P9,970,253 was generated by the model (table 3). This represents the sum of the twelfth period solution values of the outstanding loan variables: SSL, SOL, LSL, LOAL, MLL, COML, INL, and OL. Short-term agricultural loans, SSL, SOL, LSL, and LOAL account for 79 percent of the portfolio. Small farm loans, SSL and SOL, constituted 29 percent of the portfolio.

New loans granted, SSLC, SOLC, LSLC, LOLC, MLLC, COMLC, INLC, and OLC, throughout the 12 programming periods summed to P11,729,642. This exceeds the total loan portfolio outstanding at the end of the final period since the latter is already net of matured loans that were repaid. More than 31 percent of the new loans granted are in small farm loans (SSLC and SOLC). For all loan classes, the levels of new loans are at the market limits. As long as the net revenue on loans is higher than the cost of funds, rural banks will maximize their profits by granting loans up to the market limits as long as funds are not limiting. As the results indicate, the availability of funds is not an effective constraint on lending.

The outstanding year-end investment portfolio equalled P1,005,135, inclusive of the investment in preferred stock redemption of P8,110 which was assumed constant during the programming periods. The increase in the investment portfolio originates solely from increases in the investments in Agrarian Reform Credits (ARC).[4] Starting with an initial level of only P383,711 during the first period, this type of investment rose to P997,025 at the end of the final period.

An optimal mix of current liabilities heavily concentrated in CB rediscount borrowings (P5,592,628 in rediscounted supervised agricultural loans, SREDSC plus LREDSC, and P1,280,053 in rediscounted ordinary loans, SREDOC plus LREDOC plus CREDOC plus IREDOC) was generated by the basic model. These rediscount funds account for almost 59 percent of the total loans granted throughout the 12 periods. There was a net increase of only P355,358 in savings deposits (SDC) which was almost exactly offset by a decrease in time deposits. New time deposits (TDC) totalled P512,386 but this was exceeded by the maturation of the old time deposits outstanding at the beginning of the first period. Since time deposits are the most expensive source of funds in the model and, except for other liabilities (OLIAB), rediscounting of supervised loans is the least expensive, these results were expected.

These results suggest that rural banks are highly dependent upon CB funds and that they cannot be expected to mobilize funds in rural areas as long as cheaper sources of funds are available from rediscount lines from the CB. However, time deposits could be attractive as a source of funds for investments if the spread between investment returns and time deposits were attractive. Since the spread is negative at current levels, relaxing the interest rate ceilings on agricultural loans would be a logical way to increase the spread and the incentive to mobilize such funds.

The Models

Version 1 (Basic Model): increase in loan demand forecast of 50 percent.

In this version, it is assumed that excess demand may exist only in the case of short-term agricultural loans. Since an exact measure of the excess demand is not possible, the loan demand forecast used in the basic model was parameterized in 10 percent intervals to a maximum of 50 percent above the base loan demand. The optimal solution indicates that the net profit (P) increased to P363,800 with a 50 percent increase in loan demand. The only liabilities that change are the rediscounting variables (table 3). The increases in loan demands have been met solely from increases in rediscounting which is not unexpected since rediscount funds are the lowest cost source of funds and they are not yet at their upper limit. Evidently, without the market restrictions on loan demand, the profit and ROE will increase to an unrealistically high level that will be constrained ultimately only by the available funds. The bank's portfolio specializes in loan types that have the highest net return. This illustrates how the profit contribution of a cheap rediscounting policy is so directly linked to, and constrained by, the demand for loans.

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[4] In the Philippines all banking institutions are required to maintain at least 25 percent of the loan portfolio in agricultural loans. At least ten of the 25 percent should be loans to small farmer beneficiaries of the agrarian reform program. The banks are given the option to meet this requirement by purchasing ARC securities from the CB.

A profit-maximizing bank will arbitrage indefinitely, granting rediscountable loans, rediscounting them, and using the proceeds to make further loans until the limits on rediscount funds are reached. This, of course, assumes that the net return on rediscountable loans is invariant with the volume of loans supplied and that it is higher than the rate of discount. Since the nominal rate of return and the administrative costs are assumed constant, this is equivalent to assuming that the default risk on loans is also invariant with the supply of loans; however, a positive correlation exists between risk and the supply of loans. As the risk increases to the point where the estimated net return on rediscountable loans becomes equal to or less than the rate of discount, the optimal supply of rediscountable loans will be determined. Which of the alternative loan demand forecasts corresponds to this optimum is extremely difficult to determine.

Version 2: suspension of special time deposits (STD) as a "seed fund" to support the supervised credit program of the rural banks. To enable the banks to maximize their participation in the CB-sponsored supervised credit program, the CB has also been providing the rural banks with a seed fund in the form of a three-month STD at an annual interest of three percent. This seed fund is to augment the bank's own liquid funds at the start of the season of the program and thus enable it to accommodate as many borrowers as possible whose loans can be rediscounted later with the CB to accommodate future borrowers. Quite clearly, the overall profitability of rediscounting to the rural bank is limited by the amount of initial funds it has. In the extreme case where the initial fund is zero, the bank will gain nothing from rediscounting as it will not be able to generate new loans to rediscount later.

The results from a model without the STD as a source of funds show that new loans granted during the first period suffered the most. Considering all the periods, the increase in new time deposits remains the same as in the original model, which suggests that banks do not mobilize new funds to replace STD. Also, the overall effect on the amount of funds allocated to ARC is only P2 thousand less in this model than in the basic model (table 3). Net profit (P) over the periods is P178,600, compared to P213,177 for the basic model. This profit reduction of P31,874 when related to the average monthly STD balance of P262,653 in the basic model implies a 12.14 percent return for the use of STD. And, this represents the maximum return that the banks could offer for funds to replace the STD.

Version 3: equalization of the interest rates on various rediscount funds. Currently, on supervised agricultural loans, the interest rate on rediscount funds is set at one percent compared to three percent on ordinary agricultural loans and four percent on commercial and industrial loans. The objective of interest rate differentiation is to increase the profitability of supervised agricultural loans relative to other loans and thus induce the rural banks to allocate more of their funds to supervised loans. However, as discussed earlier, as long as the costs of funds needed to finance the various types of loans are less than the net rates of returns on loans, differences in the profitability of loans are irrelevant since availability of funds is not an effective constraint. Only the market constraints effectively limit the allocation of funds among the various types of loans. Further reductions in the costs of funds will have no effect on allocation of funds as long as the market constraints remain effective. Conversely, the costs of funds could be increased without affecting the allocation of funds among the various types of loans as long as they are below the net return on certain types of loans.

As an empirical test of the above, the basic model was modified by equalizing the interest rates on rediscount funds with the rate on commercial and industrial loans as the basis. As expected, the allocation of funds among the different types of loans remains constant. Among the asset variables, only ARC and CCD were affected. The intertemporal allocation of funds to ARC changed for some periods but the overall amount of funds allocated did not change. There was, however, a reduction in the amount of liquid assets, CCBt, held by the bank. Among the liability items, only the rediscount funds were affected. There was a decrease in supervised rediscounting—SREDSCt and LREDSCt—and an increase in ordinary rediscounting—LREDOCt, SREDOCt, CREDOCt, and IREDOCt. Again this is consistent with profit-maximizing behavior since as the interest rates are equalized, the "price ratio" moves in favor of ordinary rediscounts. The equalization of discount rates resulted in a profit reduction to P157,700 (table 3). In a counterfactual sense, the profit reduction from the base model to this model represents the amount by which profit would be increased through a policy of preferential rediscount rates for agricultural loans. As evidenced by the results, however, this policy could not be expected to lead to an increase in agricultural loans unless the demand for loans increases.

Conclusions and Implications

The Philippine government, through the Central Bank (CB), initiated the rural banking system and has tried to increase allocation of loans to small farmers through changes in regulatory policy. A multiperiod linear programming model of a representative rural bank is developed to

Table 4. Definition of Selected Structural Variables in the Rural Bank LP Model, Central Luzon, Philippines, 1979–1980

CCB_t: due from Central Bank in period t
$DCCB_t$, $ICCB_t$: the decrease and the increase, respectively, in CCB
COB_t: due from other banks in period t
$SSLC_t$, SSL_t: (new) supervised small agricultural loans granted and outstanding, respectively
$SOLC_t$, SOL_t: (new) small ordinary agricultural loans granted and outstanding, respectively
$LSLC_t$, LSL_t: (new) large supervised agricultural loans granted and outstanding, respectively
$LOLC_t$, $LOAL_t$: (new) large ordinary agricultural loans granted and outstanding, respectively
$MLLC_t$, MLL_t: (new) medium and long-term agricultural loans granted and outstanding, respectively
$COMLC_t$, $COML_t$: (new) commercial loans granted and outstanding, respectively
$INLC_t$, INL_t: (new) industrial loans granted and outstanding, respectively
OLC_t, OL_t: (new) other loans granted and outstanding, respectively
$XRESC_t$, $XRES_t$: (new) nonreserve eligible securities purchased and outstanding, respectively
$ERESC_t$ $ERES_t$: (new) reserve-eligible securities purchased and outstanding, respectively
$ARCC_t$, ARC_t: (new) "agrarian reform credits" securities purchased and outstanding, respectively
SDC_t, SD_t: (new) savings deposits and savings deposits outstanding, respectively
TDC_t, TD_t: (new) time deposits and time deposits outstanding, respectively
$STDC_t$, STD_t: (new) special time deposits and special time deposits outstanding, respectively
$BGFC_t$, BGF_t: decrease in Barrio Guarantee Fund (BGF) and BGF outstanding, respectively
$BSFC_t$, BSF_t: increase in Barrio Savings Fund (BSF) and BSF outstanding, respectively
$SSDC_t$: special savings deposits outstanding
$SREDSC_t$: $SSLC_t$ rediscounted in period t and become available in period t + 1
$LREDSC_t$: $LSLC_t$ rediscounted in period t and become available in period t + 1
$SREDOC_t$, $LREDOC_t$, $CREDOC_t$, $IREDOC_t$: $SOLC_t$, $LOLC_t$, $COMLC_t$ and $INLC_t$ rediscounted, respectively, in period t and become available in period t + 1
$SREDS_t$, $LREDS_t$, $SREDO_t$, $CREDO_t$, $IREDO_t$: the end-of-period balances of different types of rediscount borrowings (t=2, ..., 12)
$IBRDC_t$, $IBRD_t$: (new) IBRD and IBRD outstanding, respectively
$OLIABC_t$, $OLIAB_t$: (new) other liabilities and other liabilities outstanding, respectively
UI_t: unearned interest income for each period
APL_t: allowance for probable losses for each period
P_t: net profit/income from loans and investments for each period
CAP_t: capital accounts outstanding for each period

evaluate the profit-maximizing level of small farm loans given the available alternative assets, and to evaluate the impact of selected regulatory changes on small farm lending and rural bank profitability.

Results from the base model are as expected, given the constraints imposed and the relative returns and costs of the various asset and liability variables. A net profit of P213,177 (16.7 percent return on stockholders equity) was obtained from the base model. An optimal year-end portfolio of P9,970,253 was generated by the model. Short-term agricultural loans account for 79 percent of the portfolio with 29 percent in small farm loans. For all loan classes, the level of new loans is at the market limits. As long as the net revenue on loans is higher than the cost of funds, rural banks will maximize profits by granting loans up to the market limits as long as funds are not limiting. The optimal mix of current liabilities is heavily concentrated (59 percent) in rediscounted agricultural and ordinary loans from the CB. Time and savings deposits are relatively unimportant as a source of funds in the model because they are the most expensive while rediscounted supervised loans are the cheapest. Rural banks are highly dependent upon CB funds and cannot be expected to mobilize deposits in rural areas as long as cheaper rediscount lines are available.

A 50 percent increase in the loan demand forecast increases the net profit of rural banks to P363,800. The increase in loan demand is met solely from increased rediscounting, which is not unexpected since rediscount funds are the lowest cost source of funds. A profit-maximizing bank will arbitrage indefinitely, granting rediscountable loans, rediscounting them and make more loans until the funds are exhausted.

Suspension of the "seed fund" causes a reduction of lending to small farmers and a reduction of banks' profits to P178,600. The results also show that banks do not mobilize new funds from time and savings deposits to replace the loss of STD. Concessional discounting policies from the CB appear to discourage banks from mobilizing local deposits.

Equalizing the interest rates on all loans reduces profits to P157,700 but does not change the allocation of funds among the various types of loans. As long as the cost of funds is less than the net rate of return on loans, differences in the profitability of loans are irrelevant since availability of funds is not an effective constraint. Only market constraints including risk considerations, effectively limit the allocation of funds among the various types of loans. As evidenced by the results, preferential interest rates increase the profitability of rural bank lending but cannot be expected to increase the flow of funds to small farmers unless their loan demand increases.

This confirms Adams's analysis that rational bankers will merely substitute cheap rediscount funds for more expensive local deposits. A piecemeal policy approach to financial reform will not likely be adequate and may only lead to unintended consequences such as increased bank profits with little or no increase in small farmer credit.

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Effects of Seller Financing on Prices Paid For Farmland

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Abstract

Seller financing of farmland has been hypothesized as contributing to high farmland prices. Net present value models have shown that sellers may find financing the transfer to be more profitable than a cash sale. Results of this study show the per acre price of seller-financed farmland was higher than the price paid for land financed by the Federal Land Bank, Farmers' Home Administration, or commercial banks.

Key words: seller financing, farmland prices, regression model.

In 1945, approximately 49 percent of the farms transferred were credit financed. By 1984, credit-financed transfers had increased to 84 percent (USDA). Sellers represent an important source of credit for farm transfers and accounted for approximately 28 percent of the transfers in 1984 (USDA). The effect of seller financing on farmland prices has been addressed in numerous studies (Barry and Levi; Nixon; and Reinsel). These studies focused primarily on the tax advantages to the seller of seller financing. The trade-off between lower interest rates and higher prices was demonstrated by Reinsel who concluded, "because interest rates are lower for seller financing, such arrangements have raised prices above those that would otherwise exist." Reinsel further pointed out that lowering the interest rate raises the effective demand for farmland. A similar conclusion was reached by Barry and Levi: "sellers may prefer a higher sale price and lower interest rate because of the lower tax obligation on capital gains relative to ordinary income."

Although seller financing frequently is cited as contributing to high farmland prices, there has been little empirical evidence presented to warrant such a conclusion. This conclusion has been drawn mainly from present value models. It is the purpose of this paper to test empirically the hypothesis that prices paid for seller-financed land are higher than prices paid for land financed through other sources.

In the section that follows, the regression model employed to measure the effect of seller financing on land prices is presented. Empirical results are then presented and discussed, with a summary and implications section following.

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Empirical Model

To measure any effect of seller financing on prices paid for farmland, the following model was used:[1]

$$Y = \beta_0 + \sum_{j=1}^{16} \beta_j X_j + \epsilon$$

where

$Y =$ price paid per acre for farmland, adjusted by the consumer price index (1967 = 100),

$X_1 =$ percent of tract classified as pastureland,

$X_2 =$ percent of tract classified as cropland,

$X_3 =$ acres in tract,

$X_4 =$ dollar value of improvements, adjusted by the consumer price index (1967=100),

$X_5 =$ rate of interest on the primary note minus the percentage change in consumer prices for the respective year,

$X_6 =$ percent of purchase price that was financed,

$X_7 =$ length of term of loan,

$X_8 \ldots X_{11} =$ binary variables representing the degree of urban influence on the tract sold: none, (X_8); slight, (X_9); moderate, (X_{10}); great (X_{11}),

$X_{12} \ldots X_{16} =$ binary variables for lender classes: Farm Credit System (X_{12}), Farmers Home Administration (X_{13}), commercial banks (X_{14}), insurance companies and other (X_{15}), seller (X_{16}),

$\epsilon =$ error term.

Percentage of the tract in pasture and cropland (X_1 and X_2, respectively) were included as proxies for land quality. Acres not in cropland and pasture were primarily in timber. Acreage in the tract purchased (X_3) was included to test the hypothesis that larger tracts sell for less per acre than smaller tracts, ceteris paribus. Since the value of improvements was not the same for all tracts, the effect of improvements on sale price was accounted for by inclusion of the variable X_4.

The rate of interest charged on the primary note for each sale was adjusted for inflation. Inclusion of an index for inflation as a separate variable was not believed feasible because of problems with multicolinearity between nominal interest rates and the rate of inflation. Therefore, the variable X_5 was expressed as the real rate of interest on the primary note. This real rate of interest was determined by subtracting the rate of inflation (measured by the consumer price index in the year the loan was initiated) from the contractual interest rate. When X_5 is positive, the interest rate exceeds the rate of inflation and the regression coefficient for X_5 would be expected to be negative. Percent of the purchase price borrowed (X_6) was included to test whether lower down payments, generally believed to enhance the marketability of land, affected price. A similar rationale was followed for the inclusion of X_7, length of term of loan.

The degree of urban influence was included to account for differences in population and demand for farmland for urban conversion throughout the state. It was felt that this approach was superior to including county populations or "dummy" variables for counties. Tracts in areas with "great" urban influence would be expected to sell for more per acre than those in areas with little urban influence.

The primary interest of this study was to test the hypothesis that land prices for seller-financed tracts were higher than prices for tracts financed by conventional sources. This can be quantified by setting up sources of financing as dummy variables. Since the class representing seller financing (X_{16}) was the omitted variable, the prices paid for land financed through other sources could be compared directly to prices paid for seller-financed land.

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[1] Data were time series cross-sectional. The model used was a fixed effects model, table 10-1, Model IIa, in Johnston.

The model was fitted to data obtained from the Federal Land Bank of Columbia, South Carolina (FLB hereafter). These data were collected by the FLB for the time period 1971–1981. Data were collected only for bona fide sales. A bona fide sale is defined by the FLB as: "The arms-length transfer of property from an informed seller to an informed buyer, neither of whom is under duress, for a price." Sales were not considered verified until the buyer, seller or both were interviewed. Thus, family transfers and forced sales were not included. Data on 3,067 sales were collected and used in this study.

Results

A backward elimination procedure was used to arrive at a final model. The criteria for eliminating a variable from the initial model were: (a) the variable was not significant at the 95 percent confidence level, and (b) when two or more variables were not significant at the prescribed confidence level, the variable contributing least to the model sum of squares was eliminated first.

Given these criteria, X_7 (term of loan) was the only variable eliminated from the model. Examination of the correlation matrix did not reveal any correlation problem between X_7 and other continuous variables. This is similar to results obtained in a 1975 study by Herr on Iowa and South Dakota farmland prices in which term was found not to be significantly different from zero.

The final model had an R^2 of 0.78 and an overall F statistic (831.30) significant at the 99 percent confidence level. As expected, cropland had a larger effect on tract value than pastureland and price per acre decreased as size of tract increased (table 1). Improvements made a positive contribution to the per acre price, but it was surprising that the coefficient for per acre value of improvements exceeded one. The coefficient of 1.15 differed from both zero and one at the one percent probability level. There are two possible explanations for this coefficient. First, if the buyer divides the purchase price into land and improvements, there is a tendency to overestimate the value of the improvements because improvements can be depreciated to reduce income tax liability while the land cannot be depreciated. Second, it may be that the value of improvements was understated for loan purposes. Since lenders normally will loan a higher percentage on the value of land than on improvements, buyers can qualify for a larger loan by understating the value of improvements and overstating the value of land.

The overall F statistic for degree of urban influence was significant at the one percent probability level. Signs and relative magnitudes of the coefficients for the dummy variables were consistent with theory. The omitted variable was for great urban influence. Thus, negative signs for the other classes were expected. Land with great urban influence sold for approximately $376 more per acre than tracts with no urban influence, other factors held constant. As the degree of urban influence increased, the effect on price increased, as was expected.

The financial variables retained in the model were real interest rate, percent of purchase price borrowed, and type of lender. For every one point increase in the interest rate charged, holding the rate of inflation constant, the adjusted sale price per acre declined by $6.30. The coefficient for percent of purchase price borrowed was negative and significantly different from zero at the one percent probability level. At first glance, this appears inconsistent with theory. It generally is believed that a lower down payment results in a higher sale price. In the Herr study, the coefficient for percent of purchase price financing also was negative for both the South Dakota and Iowa models, and significantly different from zero for the South Dakota model. Herr attributed the negative sign to correlation problems with nonagricultural influences or to "lender's adaptation to risk rather than representing a causal factor determining farmland values." No correlation problems were found for the variables in the study reported here.

Indeed, it may be the case that percent borrowed is not a causal factor, but one that reflects either the credit rating of the borrower or a "good buy." A buyer with a high credit rating would be expected to be able to finance a higher percentage of the purchase price than one with a lower credit

Table 1. Estimated Coefficients and Standard Errors for Variables in the Model

Variable	Estimated Coefficient (standard error)	Variable[a]	Estimated Coefficient (standard error)
Constant	737.36* (32.03)	X_8	-376.0* (27.47)
X_1	190.98* (17.65)	X_9	-329.0* (28.80)
X_2	237.71* (13.95)	X_{10}	-243.0* (29.11)
X_3	-0.09* (0.01)	X_{11}	0.0
X_4	1.15* (0.01)	X_{12}	-72.01* (13.35)
X_5	-6.30* (1.61)	X_{13}	-73.44** (32.15)
X_6	-0.76* (0.19)	X_{14}	3.47 (23.05)
X_7	deleted	X_{15}	-67.97* (25.63)
		X_{16}	0.00

[a] The overall F statistic for X_8, X_9, X_{10}, X_{11}, was 92.20 significant at the one percent probability level. The overall F statistic for variables X_{12}, X_{13}, X_{14}, X_{15}, X_{16} was 10.33 significant at the one percent probability level. Nonzero coefficients for the dummy variables (X_8 through X_{16}) are for comparison to the omitted variables, zero coefficient, and test of significance is for the respective coefficient to the omitted variable.

*Significant at the one percent probability level.

**Significant at the two percent probability level.

rating. This would enhance the bargaining position of the individual with the higher credit rating. Likewise, lenders loan higher percentages on tracts purchased at less than market value, assuming other factors constant. For tracts that were seller-financed, the mean percentage of purchase price financed was 66.58, while the tracts financed by the Farm Credit System had a mean of 78.24 percent of sale price financed.

The overall F statistic for the dummy variables for type of lender was significant at the one percent probability level. This indicates that prices paid for farmland differ by source of lender. The next step was to compare prices for other lenders to the price for seller-financed land. Results in table 1 show that prices paid for land financed by the Farmers Home Administration, the Farm Credit System, and insurance companies and others were lower than prices paid for land that was seller financed. Prices paid for farmland financed through commercial banks were not significantly different from seller-financed prices. Further, the differences above were significant at the two percent probability level or higher. It is important to note that these differences are net of the effects of interest rates, percent of purchase financed, land quality, tract size, degree of urban influence, and so forth. That is, holding all other explanatory variables at their means, a tract of land financed through the Farm Credit System would sell for $72.01 per acre less than one that was seller financed.

The question arises, "What causes the price premium for seller financing?" One reason proffered here is that the difference primarily has been due to risk. That is, the buyer could not obtain a loan from any conventional source and thus had to pay a premium. While this line of reasoning could not be tested empirically, it can be substantiated if one accepts the argument that percent borrowed reflects credit rating since a higher down payment was required under seller financing. Another possible reason is that interest rates and percent borrowed did not account for other loan features such as balloon payments or interest-only payments for part of the term. Both of these likely would affect the price but were not accounted for because of lack of data.

Summary

A regression model was used to evaluate the effect of seller financing on farmland prices. Other independent variables in the final model were percent of tract in cropland, percent of tract in pasture, acres in tract, dollar value of improvements, real rate of interest paid to finance purchase, percent of purchase price financed, and degree of urban influence. The regression model was fitted to data obtained from the FLB of Columbia, South Carolina, for the years 1971–1981.

Cropland had a larger effect on per acre price than pasture, and the price per acre declined as the size of tract increased. The dollar value of improvements had a coefficient of 1.15. The coefficients for the real rate of interest and the percent of purchase price financed were both negative. As the degree of urban influence increased, the positive effect on per acre price increased.

The primary interest of this study was to test the hypothesis that per acre prices for seller-financed land are higher than sales financed by conventional lenders. The results indicate that prices paid for farmland are affected by source of credit. Prices paid for seller-financed farmland are higher than prices paid for farmland financed by other sources. Since the effect of interest rates, percent of purchase borrowed, and term of loan were accounted for, these higher prices may represent a premium for risk. Since seller financing is involved in a significant portion of land transfers, these higher prices have implications for the farmland market and should be addressed in further research.

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Multiperiod Linear Programming Simulation of Cooperative Loans for Analyzing Equity Capital Programs

Ismail Ahmad, Ken D. Duft, and Ron C. Mittelhammer

Abstract

Increased demand for debt capital, inflation, and the advent of expanded borrower eligibility have prompted Banks for Cooperatives to implement new equity capital programs or adjust the components of pre-existing programs. This paper describes the use of a multiperiod linear programming model for selecting optimum equity capital program components and also describes the means by which the true financing rate can be measured. Results suggest that programs can be structured to the advantage of the borrower while protecting the debt-to-equity positions of cooperative lenders.

Key words: cooperative finance, multiperiod linear program, equity capital optimization, true cost of financing, Banks for Cooperatives.

In recent years, a number of Banks for Cooperatives (BCs) have implemented new equity capital programs, while other BCs are currently considering a shift to new capital programs (Cobia). Major factors prompting the BCs to examine their capital programs are: (a) the increase in demand for BC loans from member borrowers (Moore and Fenwick) and (b) the recent entry into the BC system of large new borrowers such as rural electric generating and transmission cooperatives (Duft and A.D. Little). Any shift in equity capital program components impacts the lender's base of support capital and the borrower's true cost of debt.

The objectives of the new equity capital programs implemented by cooperative lenders (BCs) are: (a) to maintain credible equity to loan balance outstanding (Equity:LBO) standards which refer to borrower equity in the BC measured against BC loans made to borrowers; (b) to lessen the disproportionate capital burden on existing member-borrowers (especially when new, large, undercapitalized borrowers enter into the system); and (c) to ensure that ownership of the cooperative lender remains in the hands of those cooperative borrowers currently using BC system services and resources (see Cobia, p. 3). In evaluating new capital programs, the cooperative lender must consider its own viability and also the welfare of its cooperative borrowers since both lender and borrower subscribe to basic cooperative principles. In other words, rather than being profit oriented, cooperative lenders and borrowers should aim to provide services so as to maximize the net worth of member-patrons.

The loan component characteristics (see

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table 1) of a BC loan can be complex, and have been shown to have significant financial impacts on cooperative borrowers (Duft). Duft has shown that certain component configurations enhanced the cooperative borrower's position at the expense of the bank, others enhanced the bank's interest at the expense of the borrower, and still others improved the borrower's position while not adversely impacting the bank's position. Therefore, it seemed reasonable that a "mix" of these loan components existed, such that borrower interests would be enhanced, perhaps even optimized, while still remaining in compliance with a bank's specific loan policy constraints, and Equity:LBO standards.

This study develops a multiperiod linear programming model that can be used as a planning tool for analyzing the choices and time paths of the various equity investment programs available in a particular bank-borrower situation. The model is designed to accept, as input, a future interest rate scenario, the rate of return on investment appropriate for a given borrower, and constraints defined by a BC on the time paths of Equity:LBO and loan component usage. The program returns the feasible loan component configuration that maximizes the addition to borrower net worth provided by the loan project. This work also provides the analytic framework for calculating the true financing rate of the BC financing package.

An obvious concern is that a loan component configuration chosen to be optimum from the borrower's perspective might fail to protect the interests of the bank and/or fail to consider the impacts on the lender of variations in equity cash flows over time. However, lender welfare is protected in the programming model via the specification of a set of feasible time paths for loan component implementation and equity capital accumulation.

The model promotes borrower welfare by assuring that among the complicated choices of equity capital programs available for meeting bank-specific equity accumulation targets, the choice is made that meets bank requirements at minimum borrower cost. Equity accumulations requisite to loan volume activity in the BCs are noninterest bearing. Therefore, an opportunity cost to borrowers is involved whenever it is required of them to invest in such equities. Given the various methods by which borrowers can accumulate equity, an inadvertent choice of equity program, although meeting the time path of minimum equity accumulations required by the bank, may result in the borrower becoming overcapitalized in certain time periods during the loan term, and thus a borrower may be forced to incur unwarranted opportunity cost penalties. The model seeks to minimize or eliminate the over-capitalization problem via the optimum feasible choice of loan component configuration. In particular, the model can be used to identify constraints on loan component choice that inherently lead to overcapitalization, and to analyze borrower costs of requiring the use of various equity accumulation methods.

Overall, this study provides the BC and the cooperative borrower with a mechanism for simulating loan environments and identifying associated constrained optimum equity capital programs that can be used to generate comparative information useful for the actual negotiation of an improved total financing package.

General BC Loan Environment

The BCs employ a variety of equity capital program components to facilitate borrower equity investment in the BC system. Target levels of borrower equity investment (expressed as a percentage of loan balance outstanding) and the time periods allowed for borrowers to reach these targets vary somewhat from bank to bank, but all the BCs strive to maintain the system's minimum standard of a borrower leverage ratio of 12:1 (where the ratio refers to BC total loans outstanding relative to total borrower owned equity in the BC). However, because of seasonal variations inherent in cooperative finance, most BCs attempt to operate at a more conservative ratio of 8:1. The various loan components specified by the BCs to facilitate equity accumulations are described in table 1.

The pattern of net cash flows evolving from within BC term loans is relatively complex compared to those associated with standard

Table 1. Definitions of Loan Components

Override. Cash payments made by the borrower to purchase equity in the BC. The level of override payable in any period is normally expressed as a percentage of the annual interest due on the BC loan, and is paid by the borrower at the time of and in addition to regularly scheduled principal and interest payments.*

Advance capital. A separate loan made to the borrower specifically for equity purchases in the BC. This is normally assessed as a percentage of each loan advance and is repaid in concert with the normal schedule of principal payments.

Patronage retained. Cooperatives return to their member-patrons the annual savings (patronage) that result after deducting operating expenses and other authorized items. A BC may retain a portion (not to exceed 80 percent) of the patronage, if necessary, to maintain or enhance the Equity: LBO levels of its borrowers.

Equity revolve period. This represents the period of time between a borrower's purchase of BC equity and its subsequent cash redemption; commonly referred to as the act of "revolving out."

Reinvestment. The BC may elect to retain a portion of equity that is scheduled to be redeemed if such a practice is deemed necessary to maintain a borrower's Equity:LBO standards. Such equities may be forcibly reinvested for another equity revolve period to retain a borrower's equity at required levels.

*More recently, as interest rates rose dramatically, some BCs elected to assess override as a percentage of a borrower's current LBO. For purposes of this analysis, however, the assessment base is indistinguishable and would affect only the level of assessment, not the manner in which it was analytically simulated.

loans from commercial banks. When a term loan is secured from a commercial bank, typically there is an initial net cash flow in the borrower's favor followed by a series of net cash flows—resulting from interest payment and principal repayments—in favor of the bank during the remaining period of the loan. With BCs loans, however, as a result of the complex features of earned patronage and equity programs, net cash flows may occur in favor of the borrower not only at the beginning of the loan period when loan advances take place, but also at intermittent times during the remaining period of the loan term which can complicate the calculation of the true cost of financing in a BC loan (to be discussed in a subsequent section). The various cash flows that can take place are illustrated in the prototype BC loan discussed below. Typically, patronage, equity revolve, and reinvestment activities occur only in the fourth quarter of each year. Other cash flows can occur in any quarter of the year.

Multiperiod Linear Programming (MPLP) Model of a Prototype BC Loan

An MPLP model was developed to select an optimal mix of loan components that would maximize additions to borrower net worth, in present value terms, subject to bank borrower specified equity capital constraints, an interest rate scenario, and the borrower's rate of return on invested capital. The objective function to be maximized in the model represents the difference in present values of the cash inflows (flows from bank to borrowers) and cash outflows (flows from borrower to bank). The cash flows are multiplied by a discount factor that represents the borrower's opportunity cost of money, so that the objective function is a measure of the contribution to the borrower's net worth position that would result from the use of the BC loan funds in the borrower's cooperative business. In this study, a 10 percent discount rate was used to reflect the cooperative borrower's opportunity cost of money.[1] This figure is based on a survey of BCs which revealed that a 10 percent return on investment would be a representative figure to apply to cooperative borrowers.

In order to construct the prototype model, a financing package of a specific type, duration, and amount was specified. The BC system provides only three general types of loans (seasonal operating, seasonal

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[1] There has been some debate in the finance literature regarding the choice of an appropriate discount rate in the objective function of an MPLP model, formulated to solve capital (or financial) budgeting problems. Lockett and Tompkins have stated, "the problem is to determine the relevant discount rate with which to calculate the net present values of the objective function when this same rate is dependent upon the optimal solution." The latter comment was made especially with respect to problems of portfolio selection where capital is rationed over several investment periods. In the MPLP model used here, capital rationing is not assumed, and the problem of project selection does not arise in a single-project problem.

Table 2. Summary of Loan Components and Constraints Timing in Prototype MPLP

Loan Period	Year	Year 1 & 2	Year 3	Years 4-10		Years 11-17
	Qtr.	Q_1 Q_2..................Q_8	Q_9 Q_{10}.....Q_{12}	Q_{13} Q_{14}......Q_{23}	Q_{24} Q_{25}......Q_{40}	Q_{41} Q_{42}......Q_{68}
		*Loan Advances *		*Principal Loan Repayments	*	
		*Advance Capital Loan *		*Advance Capital Loan Repayments	*	
Components		*Override Assessments	*			
		*Interest Assessments			*	
					*Equity Revolved (cash or reinvested)	*
					*Reinvestment *	
		*Patronage (cash or buy equity) in the last quarter of each year			*	
		Main Loan Advances Total ≦$500,000				
Constraints		*Advance Capital * Total ≦ $50,000				
		*Override Total ≦ 20% of Quarterly Interest ≦15% of 3 year total interest	*			
		*Equity: LBO of 1:8 must be met by Q_{12}	*		*Equity: LBO of 1:8 must be maintained	*
		*Minimum of 20% and maximum of 50% of patronage pay as cash; remainder reinvested in equities			*	
					*Three choices of equity revolve period length: 5, 6 or 7 years	*

Table 3. Key Equations and Inequalities in MPLP Prototype Model

	Equations or Inequalities	Reference Periods t = quarters, n = years
T1	$CLBO_t = LADV_t + CLBO_{t-1}$	t = 1, 2, ...8
T2	$CLBO_t = CLBO_{t-1} - PRIN_t$	t = 13, 14, ...40
T3	$ADCP_t \leqq \$12{,}500$	t = 1, 2, ...8
T4	$CALB_t = CALB_{t-1} + ADCP_t$	t = 1, 2, ...8
T5	$CALB_8 \leqq \$50{,}000$	t = 1
T6	$CALB_t = CALB_{t-1} - PRAC_t$	t = 13, 14, ...40
T7	$QINT_t = U_t\,(CLBO_t + CALB_t)$	t = 1, 2, ...40
T8	$OVRD_t \leqq 0.2\,QINT_t$	t = 1, 2, ...12
T9	$\sum_{t=1}^{12} OVRD_t \leqq 0.15\,(\sum_{t=1}^{12} QINT_t)$	t = 1, 2, ...12
T10	$PATR_t = .14\,(\sum_{i=0}^{3} QINT_{t-i})$	t = 4, 8, 12, ...40
T11	$CSPT_t \geqq 0.2\,PATR_t$	t = 4, 8, 12, ...40
T12	$CSPT_t \leqq 0.5\,PATR_t$	t = 4, 8, 12, ...40
T13	$PATR_t = CSPT_t + PRET_t$	t = 4, 8, 12, ...40
T14	$8CEQT_t \geqq CLBO_t + CALB_t$	t = 12, 13, ...40
T15	$CEQT_t = CEQT_{t-1} + ADCP_t + OVRD_t + PRET_t$	t = 1, 2, ...23
T16	$EQRV^n_{4(n+5)} + EQRV^n_{4(n+6)} + EQRV^n_{4(n+7)} = \sum_{i=0}^{3} (ADCP_{4n-i} + OVRD_{4n-i} + PRET_{4n-i} + REIN_{4n-i}$	n = 1, 2, ...10
T17	$EQRV_t = \sum_{i=5}^{7} EQRV_t^{(t/4)-i}$	t = 24, 28, 32, ...68
T18	$EQRV_t = REIN_t + EQPD_t$	t = 24, 28, 32, ...68
T19	$CEQT_t = CEQT_{t-1} - EQRV_t + REIN_t + PRET_t$	t = 24, 25 40
T20	$CEQT_t = CEQT_{t-1} - EQRV_t$	t = 41, 42 68
T21	$CSIN_t = LADV_t + ADCP_t + CSPT_t + EQPD_t$	t = 1, 2, 3, ...68
T22	$CSOT_t = PRIN_t + PRAC_t + U_t\,(CLBO_t + CALB_t) + ADCP_t + OVRD_t$	t = 1, 2, 3, ...68

commodity, and term) and only term-type loans establish loan balances that extend over a number of years and, thereby, require borrowers to attain and maintain equity capitalization levels beyond a year. Thus, the model was that of a term loan, where a 10-year term was selected and judged to be of sufficient length during which virtually all BCs would require borrowers to attain minimum levels of equity accumulation.

The prototype loan model incorporated specific assumptions concerning certain loan terms such as main loan advance, principal repayment, and interest payment schedules. Due to particular production and/or marketing activities, a given cooperative borrower will generally have a need to seek a set of custom-made loan terms. The model does not preclude the use of irregular advances, balloon payments, interest deferrals, and the like. In fact, virtually all of the characteristics of a prototype loan can be altered to suit a specific BC/borrower situation. The specific characteristics of the prototype model used here provide the model with a specific structure that can be used as a base from which specific BC situations can be accommodated (see the loan simulation section, where alterations are made to simulate an actual loan package under a current BC system).

An overview of the major constraints placed on the prototype loan project is presented in what follows. There was a total of 483 rows and 967 activities in the MPLP model, and the reader interested in finer detail should consult Ahmad. Referencing table 2 while reading the overview of model constraints will aid the reader in understanding the time flow of the MPLP model. Also, sequential references to equations and inequalities in table 3 will be made in the discussion, a reference Ti referring to the i^{th} equation or inequality of table 3.

Prototype Loan Characteristics

In the prototype MPLP, a $500,000 term loan was to be repaid within 10 years from the date of first advance. The loan advances were to be disbursed to the borrower in equal quarterly amounts over the first two years of the loan term. (The typical BC loan is used for an investment project that requires a series of such advances rather than a lump sum disbursement). The cumulative loan balance outstanding in any of the first eight periods, $CLBO_t$ is given by the sum of the prior loan balance outstanding, $CLBO_{t-1}$, and loan advances during the period, $LADV_t$ (T1).

The main loan is amortized over the seven-year period from years four through 10. The amortization schedule for the main loan is externally calculated and based on the quarterly interest rate scenario used in the definition of the loan environment. For the prototype quarterly interest rate scenario, the actual average interest rate cycle experienced by the 12 district BCs during 20 quarters beginning in the third quarter of 1971 and ending in 1976 was used and repeated to construct a 10-year quarterly interest rate scenario (see Ahmad, p. 84). In particular, the quarterly interest rates used were distinctively cyclic in nature, reaching a trough of 9.93 by quarter 10 and peak of 13.51 by quarter 20. Of course, any rate scenario could have been selected in constructing the prototype model. The rate scenario used has exhibited rate variations that were larger than ever before experienced, and thus provides an example of loan component analysis in a context of volatile interest rate adjustments. Other scenarios can be straightforwardly accommodated. The amount of principal repayment in each quarterly period, $PRIN_t$, is subtracted from the $CLBO_t$ starting in quarter 13 to establish a sequential decline in the loan balance outstanding until the principal is fully repaid in quarter 40 (T2).

Advance Capital

Advance capital (ADCP) loans to purchase equity are limited to a maximum of 20 percent of the loan advance, or $12,500, per quarter (T3). The cumulative advance capital loan advance (CALB) in a given quarter is equal to the prior balance plus the amount of advance capital loaned in the quarter for quarters one through eight (T4). The total of advance capital loans during the two years when advance capital loans are made is constrained to be a maximum of 10 percent of the main loan total, or $50,000 (T5). The advance capital loan principal is repaid in 28 equal quarterly repayments (PRAC) beginning in quarter 13 (T6; $PRAC_t = CALB_8/28$).

Interest

Quarterly interest (QINT) payments are based on the specified quarterly BC interest rate, U_t, and the total loan balance outstanding by the borrower, including both the amount of the main loan balance plus the advance capital loan balance, CLBO + CALB (T7). Interest charges cease after quarter 40, when total loan balance principal is repaid.

Override

Override assessments (OVRD) to purchase equity were allowed during the first three years of the financing project. An override charge of up to 20 percent of a quarterly interest payment was allowed in each of the first 12 quarters (T8). The total amount of override charges during the first three years was constrained to be a maximum of 15 percent of total interest payments during the period (T9). Override charges cease beginning in the fourth year of the financing project.

Patronage

It is assumed that patronage earned (PATR) is available in the fourth quarter of each year in an amount equal to 14 percent of total yearly interest payments (T10, based on BC survey information). A minimum of 20 percent and a maximum of 50 percent of the patronage earned can be paid to the borrower as cash (CSPT, T11, and T12). The total amount of patronage available in the fourth quarter of a year is distributed between a cash payment to the borrower, CSPT, and patronage retained, PRET, to buy borrower equity (T13).

Equity and Equity Revolve

The minimum borrower Equity:LBO was set equal to .125 which is in the range of current BC system standards. It is assumed that the BCs would allow borrowers up to three years to accumulate borrower equities to the specific minimum borrower equity level. Then, by the twelfth quarter, cumulative equity purchases, CEQT, by the borrower are required to equal or exceed .125 of the total of loan balances outstanding and the ratio of Equity:LBO must equal or exceed .125 through the fortieth quarter of the financing project (T14).

During the first 23 quarters, equities can be accumulated using any feasible combination of advance capital loans, override payments, and retained patronage (T15). Starting in quarter 24 and beyond, maintenance of Equity:LBO standard becomes complicated due to the introduction of equity revolve and reinvestment possibilities. Specifically, equity revolve periods of lengths five, six, or seven years are allowed. For example, equity purchased in year n can be revolved out no sooner than the fourth quarter of the year n+5, but must be revolved out by the fourth quarter of year n+7 (see equation T16, where $EQRV^n_j$ represents equity purchased in year n that is revolved out in quarter j). The five to seven year equity revolve period used here encompassed the range of revolve period lengths actually employed by district BCs. While other periods might have been (and can be) utilized, this range of revolve period lengths included states into which all BCs had converged. Equity revolved in quarter t, $EQRV_t$, can then consist of portions of equity purchased in years (t/4)-5, (t/4)-6, or (t/4)-7 (T17).

The equity revolved in quarter t is distributed between the amount of equity paid back to the borrower, EQPD, and the amount, if any, reinvested to buy equity, REIN, in order to maintain the Equity:LBO standard (T18). Thus, for quarters 24 through 40, the cumulative equity balance of the borrower in any quarter is equal to the cumulative equity account in the previous quarter, minus any equity revolved, plus any reinvestment of equity revolved, and plus any patronage retained (T19; note that since ADCP ceases after quarter eight and override ceased after quarter 12, these variables would have zero values in T19 and are dropped).

After quarter 40, all of the loan principals have been repaid, and thus there is no longer an Equity:LBO standard to maintain. Thus, beyond quarter 41, the current equity account is sequentially depleted by equity revolved, none of which needs to be reinvested (T20).

Cash Flow Summary

Cash inflow (bank to borrower), CSIN, in a quarter is the summation of any main loan advances, advance capital loans, cash patronage payments to the borrower, and equity revolves paid to the borrower during the quarter (T21). The CSIN activity is multiplied by the appropriate positive discount factor for the quarter, and is added to the MPLP objective function.

Cash outflow (borrower to bank), CSOT, in a quarter is the summation of any advance capital loan proceeds (which are used by the borrower to purchase equity and are thus conceptually an outflow as well as an inflow), principal and interest payments on both the main loan and on the advance capital loans, and override payments during the quarter (T22). The CSOT activity is multiplied by the negative value of the appropriate discount factor for the quarter, and is added to the MPLP objective function.

The objective function is, thus, the discounted sum of cash flows produced by the financing project. The objective function spans 68 quarters in which net cash flows can conceptually occur. The final seven years of the financing project are included solely to accommodate the maximum seven-year equity revolve period, since loan advances and payback are completed within the first 10 years of the project.

Project Appraisal and the Rate of Financing

Regardless of the direction of net cash flows after the initial flow to the borrower, the desirability of the financing project can be appraised using the net present value (NPV) concept (Jean). The appraisal is accomplished in the usual way by dividing each net cash flow in the sequence by a compound rate of return as

$$NPV(r) = \sum_{i=0}^{n} a_i/(1+r)^i \qquad (1)$$

where a_i is a net cash flow in the sequence and r is a specified rate of return. If $NPV(r)>0$, then at rate of return r the project adds to the net worth of the borrower. In comparing financing projects, the financing project with the higher NPV at rate of return r would be preferable on the basis of additions to the borrower's net worth.

The objective function of the MPLP prototype BC loan is expressed in the form (1). Therefore, if the optimal MPLP solution has chosen a mix of loan components that results in a positive value of the objective function, then the financing project is acceptable to the borrower on the basis of adding to net worth.

The rate of financing compared to the rate of return is another criterion that can be used to appraise financing projects, and the rate of financing itself is important as a measure of the cost of borrowed funds. However, depending on the pattern and level of net cash inflows and outflows, the rate of financing may be functionally dependent on the rate of return, and standard methods for calculating the rate of financing may be inapplicable. In order to examine this problem further, it is useful to categorize a financing project according to whether it is a simple or nonsimple project.

A simple financing project is one in which $a_0 > 0$, and $a_i \leqq 0$ for $i=1, ..., n$; in other words, there is an initial net cash inflow (positive) to the borrower, followed exclusively by net cash outflows (negative) and possibly periods of zero net cash flow. Conventional bank loans are generally simple financing projects. The calculation of the rate of financing associated with financing project $(a_0, a_1, ..., a_n)$ in the simple project case is done in the usual way by finding the positive discount rate that equates the future value of the sequence of cash flows to zero, as

$$FV(k) = \sum_{i=0}^{n} a_i(1+k)^{n-i} = 0 \qquad (2)$$

A nonsimple financing project is one where cash inflows are not restricted to the initial period. Thus, a nonsimple financing project is one in which $a_0 > 0$, and

$a_i \lesseqgtr 0$ for $i=1, ..., n$. Due to the nature of cash patronage and equity revolve, BC term loans are generally nonsimple financing projects. The rate of financing in a nonsimple project can be found by first defining a generalized future value function, $FV_n(r,k)$, by the recursive relationship (Teichroew, et. al.).

$$\begin{aligned} FV_0(r,k) &= a_0, \\ FV_t(r,k) &= \lambda_t \, FV_{t-1}(r,k) + a_t, \text{ for } t=1, ..., n, \end{aligned} \qquad (3)$$

where

$$\lambda_t = \begin{bmatrix} 1+k \\ 1+r \end{bmatrix} \text{ if } FV_{t-1}(r,k) \begin{bmatrix} \geqq 0 \\ < 0 \end{bmatrix}$$

The rationale for the recursive definition of $FV_n(r,k)$ is reasonably straightforward. In the sequence of compoundings that are inherent in defining the future value, a positive balance at a given point in the sequence indicates that capital is still owed to the project, and thus, the balance should be compounded forward using the rate of financing, k, charged on the unpaid balance. However, if a negative balance results at a given point in the compounding sequence, then there exists a net capital investment in the project at that point, and the balance should be compounded at the borrower's rate of return, r, reflecting, in our context, the opportunity cost of having the capital committed to the project and unavailable for use elsewhere.

Setting the future value function defined by (3) to zero and solving for k determines the rate of financing for the project. The solution can take two general forms. It can happen that $F_n(r,k)=0$ for a value of k for which $FV_t \geqq 0$ for every t, in which case $FV_n(r,k)$ is not a function of r at all, and in fact $FV_n(r,k)=FV(k)$. Such a project is called a pure financing project, which roughly speaking, is characterized by the fact that the borrower truly remains a borrower in the sense of being in debt to the project throughout the length of the project. On the other hand, it can be the case that $FV_n(r,k)=0$ iff $k=f(r)$, which can happen only if $FV_t(r,k) < 0$ for some t. Such a project is called a mixed financing project, which roughly speaking, is characterized by the borrower actually becoming a lender at times during the project in the sense of having a net investment in the financing project.

Regarding project appraisal, if the project is a simple project, or at least a pure financing project, then it can be shown that if $r \geqq k$ (or $r<k$), then $NPV(r) \geqq 0$ (or $NPV(r) < 0$), and project appraisal on the basis of NPV can proceed accordingly. If the project is a mixed project, then the preceding rule still applies, *except* the rate of financing, k, must be compared to the rate of return, r, on which it is functionally dependent, and not just to any arbitrary rate of return (Teichroew, et. al., p. 173).

Table 4. Current and MPLP Choice Set of Loan Components for BC Y $500,000, 10-Year Term Loan

Loan Component	Current	Choice Set
Advance Capital (ADCP)	Mandatory Assessment ADCP = 4% of each main loan advance	Quarterly ADCP [0, 10]% of loan advance total ADCP 4% of total loan advances
Override (OVRD)	OVRD = 10% of quarterly interest payments throughout loan term	Quarterly OVRD = 15% of quarterly interest payments, total OVRD = 10% of total interest payments assessment only during first three years
Patronage (PATR)	PATR = 12.5%* of interest paid Retained PATR = 75% of PATR	PATR = 12.5* of interest paid Retained PATR [50, 80]% of PATR
Equity Revolve	7-year revolve period	5, 6, or 7-year revolve period
Reinvestment (REIN)	Whenever necessary to maintain Equity: LBO standard	Whenever necessary to maintain Equity: LBO standard
Equity: LBO	1:10, to be achieved at point where fixed assessments above accumulate sufficient equity—maintained thereafter. Actual period when 1:10 ratio met for case study loan = year 5, quarter 4**	1:10 to be achieved by year 5, quarter 4**

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*While earlier work employed an industry-wide average of 14 percent, BC Ys actual performance of 12.5 percent was used here.

**Choice selected such that even within seasonal variations, this ratio would never exceed the industry self-imposed standard of 1:12.

In general, given an r value, a zero of the future value function (3) will be calculated via a numerical search on k values to identify the rate of financing.

BC Loan Simulation

A variation of the MPLP prototype model was constructed to simulate an actual BC loan environment, and referred to here as BC Y to protect the anonymity of the BC which was involved. The purpose of the BC Y simulation was to provide an illustration of the potential comparative information that the MPLP model can generate concerning borrower cost and loan component configuration differences between an existing BC capital program and a constrained optimum capital program.

The main loan component features of the current BC Y capital program and the MPLP choice set utilized for BC Y are presented in table 4. Loan details of the BC Y MPLP model were identical to the MPLP Prototype BC model discussed earlier except where differences exist in the loan component choice set described in table 4. Except in the case of override, each loan component choice in the current BY Y loan environment was a point in the MPLP choice set. Override assessments were restricted to the first three years of the financing project rather than assessed throughout the loan term, the restricted period of override assessments being more in keeping with current trends in the BC system.[2]

Highlights of the MPLP results for both the prototype model and the BC Y simulation are presented in table 5. Note that the prototype model utilizes a loan component feasible set that was based on general BC system standards, while the BC Y model utilizes a feasible set that includes the actual loan component configuration employed by the specific BC, so that the feasible sets differ in certain notable respects. Two types of comparative information are available from the results obtained in solving the MPLP problems. Comparison of the current BC Y loan component configuration with the MPLP configuration illustrates the costs to the borrower of a nonoptional choice of loan components within a feasible set identified by a particular BC. Comparison between the prototype and BC Y MPLP solutions illustrates the relative costs of differing BC loan environments.

In both the prototype BC and BC Y MPLP solution, the NPV of the financing project is positive, the value being $42,135 and $49,863, respectively, and thus, either project would add to the net worth of the borrower. Both projects were mixed financing projects, with respective financing rates of 7.715 percent and 7.402 percent, given $r = .10$. Neither of the loan component configurations utilized equity reinvestment as a means of maintaining Equity:LBO standards. Advance capital loans were used to a much greater extent than override assessments to accumulate equity in the first two years when advance capital was available. Equity:LBO standards were maintained exclusively by retained patronage during years four through 10, with a minimum of patronage retained in the majority of quarters.

In comparing the two MPLP $500,000, 10-year term loans, the borrower would prefer to engage in the financing project offered by BC Y rather than the project of the prototype BC, the NPV being $7,728 higher in the former case. While the reasons for this outcome are complex and interrelated, the single most important contributing factor was the Equity:LBO requirements of the prototype BC, the ratio being higher (1:8 versus 1:10) and the period for equity accumulation shorter (three years versus five years) than for BC Y. In particular, the prototype BC financing project requires equity purchases of $68,931 in the first three years while the financing project of BC Y requires only an accumulation of $31,583. Given the opportunity cost of 10 percent on equity capital, and a minimum revolve period of five years, equity maintenance becomes quite costly in terms of NPV during the early period.

A comparison of the actual BC Y loan component configuration with the configuration specified by the MPLP solution for BC Y reveals an improvement of $6,939 in

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[2] The effect of not including the current BC Y override assessment choice in the feasible set was to remove a degree of freedom for configuring the loan components. Since this degree of freedom may or may not have been useful in further increasing NPV, the calculated cost savings via MPLP can be viewed as a lower bound.

I. MPLP Prototype BC Loan, NPV=$42,135, r=.10, k=7.715

Loan Components[1]	Quarters 1	2	3	4	5	6	7	8	9	10	11	12	13-16	17-20
Advance Capital $			12,500	12,500			12,500	12,500						
(% of Loan Advance)			(20)	(20)			(20)	(20)						
Override $				1,065			1,484	1,719	1,650	1,581	1,581	1,753		
(% of quarterly interest)				(20)			(20)	(20)	(20)	(20)	(20)	(20)		
Retained Patronage $				1,100				3,139				3,677	2,888	2,954
(% of total patronage)				(59)				(80)				(80)	(50)	(50)
Equity Purchase $		27,165				31,324				10,242			2,888	2,954
Equity Revolved $														

II. MPLP of BC Y, NPV = $49,863, r = .10, k = 7.402

	Quarters 1	2	3	4	5	6	7	8	9	10	11	12	13-16	17-20
Advance Capital $			3,098	5,000		1,902	5,000	5,000						
(% of Loan Advance)			(6)	(10)		(4)	(10)	(10)						
Override $								1,219	1,170	1,121	1,121	1,243		
(% of quarterly interest)								(15)	(15)	(15)	(15)	(15)		
Retained Patronage $				808				1,797				3,104	3,903	3,958
(% of total patronage)				(50)				(54)				(80)	(80)	(80)
Equity Purchased $		8,096				14,918				7,759				
Equity Revolved $													3,903	3,958

I. MPLP Prototype BC Loan, NPV = $42,135, r = .10, k = 7.715

Loan Components	Quarters 21-24	25-28	29-32	33-36	37-40	41-44	45-48	49-52	53-56	57-60
Advance Capital $										
(% of Loan Advance)										
Override $										
(% of quarterly interest)										
Retained Patronage $	2,360	1,498	975	738	373					
(% of total patronage)	(50)	(50)	(50)	(50)	(50)					
Equity Purchased $	2,360	1,498	975	738	373					
Equity Revolved $	27,165	18,182	11,330	11,748	6,136	2,360	1,498	975	738	373

II. MPLP of BC Y, NPV = $49,863, r = .10, k = 7.402

	Quarters 21-24	25-28	29-32	33-36	37-40	41-44	45-48	49-52	53-56	57-60
Advance Capital $										
(% of Loan Advance)										
Override $										
(% of quarterly interest)										
Retained Patronage $	2,000	1,271	829	628	318					
(% of total patronage)	(50)	(50)	(50)	(50)	(50)					
Equity Purchased $	2,000	1,271	829	628	318					
Equity Revolved $	8,906	8,637	8,684	9,008	4,209	2,000	1,271	829	628	318

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[1] In both loan simulations, no reinvestment in equity appeared in the MPLP solutions.

NPV while still achieving the bank objective of a 1:10 Equity:LBO standard by year five, quarter four. Notable differences in the MPLP solution when compared to current BC Y policy, are: (a) advance capital assessments do not occur in every quarter of the first two years, and when they do occur, generally exceed the level of four percent of loan advances; (b) no override is assessed during the first seven quarters, and then is assessed at maximum levels (which exceed 10 percent of interest payments) during the remaining five quarters of the override period; (c) the majority of equity accumulation is revolved out within five years, and 99.4 percent of accumulated equity was revolved out in six years or less (Ahmad, p. 202); (d) in seven of the 10 years during which patronage was awarded, cash patronage returned to the borrower significantly exceeded the 25 percent level paid to borrowers under current BC Y policy.

Sensitivity of NPV To Individual Loan Component Changes

While the BC Y model employed those loan components actually being used by the selected district bank, one might normally wonder how sensitive NPV computations are to incremental variations in those components used. Certain relationships would seem logical (e.g., increasing advance capital assessments would lower borrower NPV), while others are not so clearly defined (e.g., the impact of a forced reinvestment). Work conducted by Duft, and later by Ahmad, suggest that a shortening of the allowable period of equity revolve tends to lower the borrower's effective interest rate and increase the NPV, as would be expected. However as the length of revolve is reduced to periods shorter than the time allowed by the BCs for full borrower capitalization, the relationship is reversed. The reason for this lies in the fact that continued undercapitalization ultimately triggers the reinvestment provision. In fact, effective rate and NPV were most sensitive to reinvestment, which explains why the MPLP model selected split revolve periods for purposes of avoiding this added borrower cost. As expected, any increase in the allowable Equity:LBO standard (beyond 1:8) reduces required member investment and increases borrower NPV. Similar results could be found as the lending BC reduced the severity of other loan component constraints. Effective rates and borrower NPV would suggest, therefore, that a negative effect on borrower cost results from acts of leniency granted by the lending BC, but only up to the point where the borrower achieved the goal of full capitalization prior to the time of first equity revolve. When certain minimums are established by the lending BCs, one cannot choose loan components based on such individual sensitivities, but rather, one must rely on the MPLP model to select that composite of individual components which best compliment one another while interacting throughout the term of the loan.

Conclusions and Caveats

Short of running an MPLP for each specific BC-borrower situation, there are a number of general guidelines for loan component choice that have been suggested by the simulations in this study. First, an aggressive equity accumulation policy characterized by a high Equity:LBO standard, and a short period in which to achieve the standard, is quite costly to BC borrowers. If a BC cannot consider lowering its Equity:LBO standard, then lengthening the equity accumulation period would be beneficial.

Although total advance capital and total override assessments may be constrained by maximum BC-acceptable levels over the whole term of the loan, it is beneficial to allow cooperative borrowers some flexibility in negotiating the level of the assessments in each quarter. As indicated in the MPLP results, it can be advantageous for the borrower to be assessed greater amounts of advance capital and override in some quarters than others.

The MPLP results further suggest that BCs should consider paying a higher proportion of earned patronage in cash. The legal minimum (IRS Section 521) 20 percent cash patronage levels can be paid in the years prior to the time when borrower's Equity:LBO ratio is lower than the minimum level specified by the BC. Once the desired Equity:LBO ratio is attained, the cash portion of patronage could be increased (a level of up to a maximum of 50 percent was found advantageous in this study). In this regard, the authors acknowledge that while operating under Section 521, the proportionate payment of patronage in cash must be uniformly applied to all member borrowers. Despite this restriction, the results would suggest that even when viewing the entire loan portfolio as a single entity, the BC and their borrowers may benefit from year-by-year variations in the proportionate cash payment. Finally, it should be recognized that data now suggest that more cooperatives are relinquishing their tax status and drifting away from 521 constraints (Wissman, p. 18).

Reinvestment should be minimized or, if possible, eliminated entirely. Equity reinvestments are costly to members because reinvestments require that some equity be retained in the BC for another period of time that is at least equal to the BCs current equity revolve period length. Also, the MPLP analyses suggest that BCs should adopt shorter revolve period lengths (such as the five-year length) in preference to the long revolve period lengths currently employed by some BCs. However, there may be periods when the equity revolved amounts cannot be all paid in cash; paying the full amount of equity revolve may adversely impact borrower Equity:LBO levels. For such periods, a combination of revolve period lengths would appear to be beneficial. This means that the total amount of equity purchases in a particular year can be split into two or more sums that can be revolved to the borrower using different length revolve periods. The shortest revolve period can be used for equity revolves whenever it is possible to pay all of the revolve sum as cash. The advantage of splitting revolve cycles is that combination of revolve periods can be used to prevent an expensive equity reinvestment that must be committed for another full equity revolve period.

As a final note, the complexity of net cash flow patterns render the BC loan a mixed financing project, and as a result, the so-called contract rate of interest associated with the loan agreement becomes a rather inaccurate measure of the actual cost of financing. Even so-called effective interest rates estimated by the cooperative lenders fail to recognize the borrower's employment of capital during those intermittent periods of net cash inflows which may accompany the loan. Our approach provides a means for accurately assessing the true rate of financing, even under those circumstances where lender-borrower loan conditions allow for variations in net cash inflows and outflows over the loan term.

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The Effects of Equity Position, Credit Policy, and Capital Gains on Farm Survival

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Abstract

The RICESIM model was used to evaluate the impact of beginning equity, minimum required equity, and land capital gain rates on survival of a representative Upper Gulf Coast Texas rice and soybean farm for the period of 1984–1988. Credit policy was important to farmers at intermediate beginning equity positions. Credit policies that allowed leverage ratios in excess of 2.0 increased producers' probability of survival but also significantly increased the potential for lenders to incur large losses.

Key words: credit policy, capital gains, survival, simulation

Financial conditions for farm operators and farm lenders have deteriorated markedly since 1980. The farm economy has experienced a prolonged period of steady domestic and falling foreign demand which, when coupled with continued overproduction of farm commodities, has resulted in persistent downward pressure on farm incomes and, consequently, net worths of farmers. Many moderately and highly-leveraged farm operators face severe cash flow problems, declining asset values, and a decreased ability to meet debt obligations (USDA-ERS).

The current financial dilemma can be traced to events of the 1970s. During that period, expanding export markets caused large annual increases in demand for agricultural products. High farm prices encouraged expansion of farming operations. Low real interest rates encouraged use of debt in financing farm expansions. Many farmers converted their short-term assets into assets of a more long-term nature, such as equipment and land (Boehlje and Eidman). When conditions reversed in the 1980s, many farmers who had expanded their operations using debt capital suddenly found they could not service their higher debt load.

During the 1970s, aggressive credit policies were practiced by many farm lenders. More conservative lending policies have been adopted in the last few years, however, as a result of increased loan delinquencies and increased farm bankruptcies (*Agri Finance*). When forced out of business as a result of tighter credit, farm operators frequently label the financial community as "too conservative" or unwilling to help the operator in time of need. It is often unclear, however, if the decision to not extend further

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credit prematurely forced the farm operator out of business or saved him or her from losing additional equity.

Critical factors contributing to current and future farm financial problems are the current debt level, declining asset values (particularly land), insufficient cash flow, and maintenance of credit and credit worthiness (USDA-ERS). In this study, the interrelationship of current debt, capital gains on land, and credit policy are examined in detail.

Several studies have been conducted addressing the effects of initial equity position, credit policy, and capital gain rate for land (Patrick; Helmers and Held; Musser, White, and Smith; Skees and Reid; Skees, Reed, and Pederson). Yet, when evaluating the relative importance of these three variables on farm survival, all are limited by one or more factors. Only two or three beginning equity ratios and credit policies (i.e., required minimum equity levels) were examined in each study. The equity ratios and credit policies examined do not represent the wide spectrum of possibilities for these variables. More important, no attempt was made to examine the interrelatedness of beginning equity, credit policy, and land values on farm survival. For example, do credit policies affect all farm operators in the same manner, or are some producers more vulnerable to negative effects from credit policy than others? Most of the studies examined full-owner and part-owner farm situations, even though tenant operations have been judged most vulnerable to insolvency under the current farm policy (Grant, Richardson, Brorsen, and Rister). In addition, some behavioral assumptions were made about the representative farm operator that are not realistic for the current farming situation. For example, farm growth was allowed in all but the Skees and Reid study and was implicitly encouraged in some studies through favorable assumptions. Whereas growth was of some importance to farmers in the 1970s, it is currently of low priority to many farmers, especially those struggling to survive.

In addition, an examination of beginning equity, credit policy, and land value effects on farm survival also provides valuable insights to policy makers. Several proposals have recently been suggested for dealing with the current debt crisis in agriculture (Harl; Riley). Before adopting a particular bailout plan, it is critical to identify the types of farming operations with the greatest need for assistance and the level of assistance needed. Programs can then be targeted toward those farm operators who can benefit most from assistance, thereby avoiding additional program costs for those that do not need assistance and those for whom assistance is of little or no value.

The purpose of this study is to examine the effects of different beginning equities, credit policies, and capital gain rates for land on survivability and ending equity of a representative Texas rice and soybean farm. Emphasis is made on the influence of external credit rationing, in the form of changes in lenders' credit policy, on farm survival. Results for a fully-leased farm are contrasted with those for a partly-owned, partly-leased farm.

Simulation Model and Representative Farm

The RICESIM model was used in the analysis. RICESIM is an updated and expanded version of FLIPSIM V (Richardson and Nixon) that has been altered to explicitly account for the marketing and policy situation facing Texas rice farmers. Because studies using FLIPSIM have been published elsewhere in this journal (Nixon and Richardson) and in other journals (Condra and Richardson; Richardson, Lemieux, and Nixon), no detailed explanation of the model is given here. Briefly, RICESIM is a firm level, Monte Carlo simulation model that simulates annual production, farm policy, marketing, management, and income tax aspects of a farm over a chosen planning horizon. The model recursively simulates the farming operation by using the current year's ending financial position as a beginning financial position for the next year. Pseudo-random prices and yields simulate the actual stochastic nature of these variables.

Probability of survival is the probability the farm operator will maintain the farm's intermediate and long-term leverage (equity) ratios at less (greater) than the maximum (minimum) credit policy leverage (equity) ratio levels established by local financial institutions. The farm operator must have a positive cash balance at the end of each production year. In the model, the farm operator is forced to liquidate his farm assets if a negative cash balance exists at the end of a production year and refinancing to cover the negative balance would result in intermediate and long-term leverage (equity) ratios being above (below) the maximum (minimum) permitted level.

A representative, high level management, Upper Gulf Coast farm was analyzed in the study.[1] The farm, located in Liberty County, Texas, consisted of 2,300 acres of farmland (95 percent of which was tillable) and a 10-acre farmstead. Only eight percent of the 1982 Liberty County farms were larger than 1,000 acres, but these few farms represented almost 73 percent of the harvested acreage. More importantly, 38 percent of the farms having irrigated acreage in the county were larger than 2,000 acres. The average size of Liberty County farms with more than 2,000 acres was almost 2,600 acres. Based on these facts, the representative farm is larger than the average Liberty County farm, but is quite representative of the farms controlling most of the acreage in the county.

The wholly-leased tenant farm operator leased all farm acreage, but owned or was purchasing the land and buildings on the 10-acre farmstead. The part-owner farm operator was leasing 1,150 acres of the farm and owned or was purchasing the remaining 1,160 acres. Leased land was farmed on shares, the most common rental arrangement in the area (Griffin, Perry, and McCauley). A soybean-soybean-rice crop rotation was assumed, as it is the predominant rotation used in the Upper Gulf Coast area (Boldt and Kennedy). In 1982, these crops constituted over 93 percent of the total crop acreage in the county (U.S. Department of Commerce).

The simulation period for RICESIM was 1984–1988, with 50 iterations of the model performed for each scenario. Prices and yields were randomly generated using multivariate empirical distributions. Empirical yield distributions were subjectively estimated by farmers and agricultural experts in the study region. Empirical price distributions for soybeans were based on behavior of soybean prices during the 1973–1982 period. An econometric simulation model developed by Grant, Beach, and Lin was utilized to predict rice prices between 1973–1983. The differences between predicted and actual prices were used to develop the rice price distributions. County level price and yield data from the study area were used to estimate the price and yield correlation matrix.[2]

Participation in current farm programs for rice and soybeans was assumed. Target prices and loan rates for 1984 and 1985 were set at the values specified in the 1981 farm bill. Values for these variables in 1986–1988 were set at their respective 1985 levels.

Financial Assumptions

The 10-acre farmstead consisted of three buildings with a market value of $155,000 and land valued at $1,200 per acre. The crop land being purchased by the part-owner was also assumed to have an initial market value of $1,200 per acre. Intermediate-term assets were the same for both tenant and part-owner. The beginning market value of all farm machinery was $565,200. Intermediate debt was incurred only through equipment purchases. Both tenant and part-owner also had $20,000 in off-farm investments. The total beginning market value for tenant farm assets was $737,200. The overall market value of the part-owner farm was $2,117,200.

Eight different types of interest rates were used in the model. Annual values for these interest rates were set for each year in the five-year simulation period. The various interest and inflation rates used are in table 1. The interest rate on long-term loans obtained previous to the study period was 11.75 percent, with the interest rate on old intermediate-term loans set at 15 percent. New long-term, intermediate-term, and operating loan rates were calculated for the period 1984–1987 using the COMGEM econometric model (Penson, Hughes, and Romain). These rates ranged from 10.5 percent to 13.1 percent for long-term loans,

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[1] It was assumed the operator had a proven record of good management ability and integrity, so credit issues relating to the person were ignored.

[2] More information on the price yield distributions can be found in a study by Perry, et. al.

Table 1. Projected Interest and Inflation Rates 1984-1988

	1984	1985	1986	1987	1988
			Percent		
Annual Interest Rates:					
Pre-1984 L.T. Loans	11.7	11.7	11.7	11.7	11.7
Pre-1984 I.T. Loans	15.0	15.0	15.0	15.0	15.0
New Long-Term Loans	13.1	11.7	10.9	10.5	10.5
New Int.-Term Loans	14.8	14.9	14.1	13.7	13.7
Refinance L.T. Loans	13.1	11.7	10.9	10.5	10.5
Refinance I.T. Loans	14.8	14.9	14.1	13.7	13.7
Operating Loans	15.2	15.4	15.6	14.2	14.2
Return on Savings	11.8	11.9	11.1	10.7	10.7
Annual Inflation Rates:					
Used Machinery	0.0	0.0	0.0	1.0	1.0
Off-Farm Investments	11.8	11.9	11.1	10.7	10.7
All Other Costs	5.4[a]	4.7	4.5	4.8	5.0
On-Farm Buildings	-2.0	-2.0	-2.0	-2.0	-2.0

Source: Penson.

[a] Initial prices used in the model for new farm machinery and off-farm storage costs are for 1984. Therefore inflation rates for these costs were equal to zero in 1984.

13.7 percent to 14.9 percent for intermediate-term loans, and 14.2 percent to 15.6 percent for operating loans. For 1988, interest rates were held constant at 1987 levels.

Annual inflation rates for 14 different production costs and returns on investment were also specified in the model. In most cases, the general inflation rate predicted by COMGEM for farm inputs was used to inflate production costs. The annual rates used were: 5.4 percent in 1984, 4.7 percent in 1985, 4.5 percent in 1986, 4.8 percent in 1987, and 5.0 percent in 1988. Inflation rates for used equipment were zero percent for 1984–1986 and one percent in 1987–1988. The 1987–1988 rates reflected the expectation that used equipment will become more scarce and, thus, more valuable during the latter part of the 1980s.

Although Skees and Reid have argued land values were closely linked to farm income, others (Castle and Hoch) have maintained that additional factors may also significantly influence land values. Indeed, Pope and Goodwin found that agricultural productivity was the fifth most important characteristic considered by purchasers of rural land in Texas. Proximity of the representative farm to the Houston metropolitan area likewise causes land values to be relatively immune to farm income variation (Gilliland). For these reasons, a constant increase in land values of seven percent per year was assumed for the base analysis, seven percent being the approximate increase in area land value during 1982–1983.

In many areas throughout the country, farmland has dropped in value as a result of the recent recession. To broaden the applicability of the results beyond the Upper Gulf Coast area, a second capital gain rate of minus three percent per year was also examined.[3] This capital gain rate is in line with declines in farmland value experienced in the South during 1981–1984 (USDA-ERS). In both scenarios, capital gain rates for used equipment were zero percent per year through 1987 and one percent in 1988, with farm buildings depreciating in value two percent per year. Although market values for equipment and building may also be linked to farm income, holding their values constant across all scenarios permits examination of land capital gain rates and their effects on farm survival.

Discussion with bankers in the Liberty County area indicates a typical farm has long-

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[3] This assumes farmland values are not a function of farm income and interest rates may be inaccurate for many areas in the U.S. This assumption may limit the applicability of the results to those areas of the country. The study, nevertheless, provides some insight into the effects of land capital gain rates on survival in those areas.

Table 2. Financial Positions for a Representative Tenant Rice and Soybean Farm Located in Liberty County, Texas

	Initial Farm Equity Positions					
	.25	.40	.60	.75	.90	1.0
Total On-Farm Assets:						
Intermediate ($)	570,200	570,200	570,200	570,200	570,200	570,200
Long-Term ($)	167,000	167,000	167,000	167,000	167,000	167,000
Intermediate-Term Debt:						
Debt ($)	421,948	332,937	226,081	134,536	53,848	0
Leverage Ratio	2.85	1.40	.67	.31	.10	.00
Equity Ratio	.26	.42	.60	.76	.91	1.00
Long-Term Debt:						
Debt ($)	130,928	109,385	66,800	49,766	19,873	0
Leverage Ratio	3.63	1.90	.67	.42	.14	.00
Equity Ratio	.22	.35	.60	.70	.88	1.00
Overall Debt:						
Debt ($)	552,876	442,322	292,881	184,302	73,721	0
Leverage Ratio	3.00	1.50	.67	.33	.11	.00
Equity Ratio	.25	.40	.60	.75	.90	1.00

Table 3. Financial Positions for a Representative Part-Owner Rice and Soybean Farm Located in Liberty County, Texas

	Initial Farm Equity Positions					
	.25	.40	.60	.75	.90	1.0
Total On-Farm Assets:						
Intermediate ($)	570,200	570,200	570,200	570,200	570,200	570,200
Long-Term ($)	1,547,000	1,547,000	1,547,000	1,547,000	1,547,000	1,547,000
Intermediate-Term Debt:						
Debt ($)	421,948	332,937	226,081	134,536	53,848	0
Leverage Ratio	2.85	1.40	.67	.31	.10	.00
Equity Ratio	.26	.42	.60	.76	.91	1.00
Long-Term Debt:						
Debt ($)	1,166,438	937,482	528,455	394,485	157,794	0
Leverage Ratio	3.06	1.54	.67	.34	.11	.00
Equity Ratio	.246	.394	.60	.745	.898	1.00
Overall Debt:						
Debt ($)	1,588,386	1,270,419	754,536	529,021	211,642	0
Leverage Ratio	3.00	1.50	.67	.33	.11	.00
Equity Ratio	.25	.40	.60	.75	.90	1.00

and intermediate-term equity to asset ratios of .60. This level of equity (60 percent) was used as the base beginning equity level for both tenant and part-owner. In addition, five other beginning equity levels, ranging from 25 percent to 100 percent, were identified for analysis. These five financial positions were chosen to represent the range of equity positions in the study area. Detailed descriptions of each beginning equity position examined for tenant and part-owner, respectively, are indicated in tables 2 and 3.

As noted before, RICESIM liquidates the farming operation when a negative cash flow exists and the farm has been leveraged to the maximum level allowed by the financial institution. In other words, the institution approves loan refinancing for the farm strictly on the basis of financial ratios, ignoring all other considerations. In reality, bankers evaluate several factors before approving or denying a loan request. Some factors considered by the Federal Intermediate Credit Bank and PCAs of Texas include: (a) the person requesting the loan, (b) purpose of the loan, (c) repayment capacity, (d) collateral taken as security, and (e) financial position and progress (Federal Intermediate Credit Bank of Houston). A study by Dunn and Frey found, nevertheless, the liability to asset ratio (equity ratio times leverage ratio) was "by far the most important . . . (characteristic used by loan officers) in determining whether a loan would become acceptable or a problem" (p. 65).

Bankers in Liberty County indicated it is not their policy to extend further credit to a farm operation with a leverage ratio above 2.0 (i.e., a minimum equity ratio of .33). This leverage ratio was used as the base level in the study. In additon, five credit policy leverage ratios were identified to examine the impact of both tighter and less restrictive levels of credit on farm survival and economic success. The five additional leverage ratios (minimum equity positions) were 1.0 (.50), 1.5 (.40), 2.5 (.286), 3.0 (.25), and 4.0 (.20). For each credit policy, the same required leverage (equity) ratio was used for both long-term and intermediate-term debt. Part-owner operations were not allowed to sell land to avoid farm liquidation.

Results and Analysis

Probabilities of survival for the tenant and part-owner situations at each beginning equity position and credit policy, assuming a capital gain rate of seven percent per year for land, are presented in table 4. Probabilities of survival exceeded ninety percent when beginning equity ratios were above .90 for the tenant and above .75 for the part-owner. The tenant's probability of survival was above 80 percent when beginning equity ratios were .60 and above and minimum required equity was less than 25 percent. Similarly, survival was above 80 percent for the part-owner when beginning equity ratios were .40 and above. At a beginning equity ratio of .25, both tenant and part-owner had less than a 25 percent chance of surviving through 1988. In comparing the tenant and part-owner results when the capital gain rate for land is seven percent, the part-owner is as well off as, or better off than the tenant when both have the same beginning equity positions.

Credit policy had little impact on survival when equity ratios were .75 or more for the tenant, or were .60 or more for the part-owner. Credit policy also had little effect on survival of the tenant or part-owner at low beginning equity levels, (i.e., .25 equity ratios) with farm liquidation occurring over 80 percent of the time under even the most liberal credit policy. Only at intermediate equity levels (.40 to .70 equity ratios) did credit policy play a significant role in farm survival. At 60 percent beginning equity for

Table 4. Probabilities of Survival[a] for a Representative Texas Rice and Soybean Farm with Different Beginning Equity Positions and Credit Policies — Capital Gain Rate of Seven Percent for Land

Credit Policy Leverage (Equity) Ratio[b]	Initial Farm Equity Positions											
	Tenant						Part-Owner					
	.25	.40	.60	.75	.90	1.0	.25	.40	.60	.75	.90	1.0
1.0 (.5)	0	0	26	78	96	100	0	0	74	100	100	100
1.5 (.40)	0	2	58	92	100	100	0	2	100	100	100	100
2.0 (.33)	0	20	82	96	100	100	0	38	100	100	100	100
2.5 (.28)	0	36	86	98	100	100	0	70	100	100	100	100
3.0 (.25)	6	40	88	98	100	100	2	82	100	100	100	100
4.0 (.20)	18	54	92	98	100	100	14	92	100	100	100	100

[a] Probability of survival is the probability that the farm operator will maintain the farm's intermediate and long-term leverage ratios at less than maximum levels established by local financial institutions. Probability of survival is expressed as a percent.

[b] Maximum (minimum) permitted leverage (equity) ratios.

Table 5. Probabilities of Survival[a] for a Representative Texas Rice and Soybean Farm with Different Beginning Equity Positions and Credit Policies — Capital Gain Rate of Minus Three Percent for Land

Credit Policy Leverage (Equity) Ratio[b]	Initial Farm Equity Positions											
	Tenant						Part-Owner					
	.25	.40	.60	.75	.90	1.0	.25	.40	.60	.75	.90	1.0
1.0 (.50)	0	0	26	78	96	100	0	0	22	96	100	100
1.5 (.40)	0	2	58	92	100	100	0	0	68	100	100	100
2.0 (.33)	0	16	82	96	100	100	0	4	88	100	100	100
2.5 (.28)	0	34	84	98	100	100	0	6	92	100	100	100
3.0 (.25)	6	40	88	98	100	100	0	10	96	100	100	100
4.0 (.20)	18	52	92	98	100	100	0	24	98	100	100	100

[a] Probability of survival is the probability that the farm operator will maintain the farm's intermediate and long-term leverage ratios at less than maximum levels established by local financial institutions. Probability of survival is expressed as a percent.

[b] Maximum (minimum) permitted leverage (equity) ratios.

the tenant, for example, a fourfold increase in the maximum permitted leverage ratio (from 1.0 to 4.0) caused probability of survival to increase from 26 percent to 92 percent. Results for the part-owner at a beginning equity ratio of .40 were even more dramatic, with survivability increasing from zero percent to 92 percent with change of the required leverage ratio from 1.0 to 4.0.

Results for a minus three percent per year capital gains rate for land are reported in table 5. The results for the tenant situation were virtually the same under both capital gain rates, a result that was not surprising since land represented less than two percent of the tenant farmer's assets. Results for the part-owner were also the same under the seven percent and minus three percent capital gain rate when beginning equity was 75 percent or more. When beginning equity was 60 percent or less, the negative capital gain rate had a significant impact on the part-owner operation. Probability of survival was less than 25 percent for the part-owner when beginning equity was 40 percent or less.

Credit policy became much more important to the part-owner at a .60 beginning equity ratio and less important at a .40 ratio. The tenant operator was only slightly worse off than the part-owner when both had .75 and .60 equity ratios and was much better off at beginning equity ratios of .25 and .40. The results suggest, for the capital gain levels tested here, only part-owners in intermediate and high debt positions are threatened by depreciation in land value. In addition, the part-owner faced with an expected negative capital gain rate on land and a high debt position may well improve his or her chances of survival by selling land and continuing to farm as a tenant. These conclusions for the part-owner are even more applicable to a full-owner operation.

Effect of Relaxing Credit Policy

From the survivability results presented thus far, it appears both tenant and part-owner farmers in the intermediate debt range (i.e., 0.40 to 0.60 equity ratios) are particularly sensitive to credit policy. If the lender relaxes credit policy, the farmer has a much greater chance of still being in operation at the end of 1988. The survivability statistics do not, however, provide an indication as to the financial well-being of the farmer at the end of the five-year period at different credit policy levels. The surviving farm operator could be either on the brink of bankruptcy in 1988 or free of any debt.

Nor do the survivability results provide any insight into whether tighter credit policies tend to prematurely force operations into insolvency. We define a prematurely insolvent operation as one that would be forced out of business at an initial credit policy but, when given additional credit, is able to recover from its precarious financial position. In the context of this study, farms forced out prematurely are those whose leverage ratios rise above the cutoff level for credit in one year (thereby causing farm liquidation), but survive under a more liberal credit policy and finish the five-year period with a lower leverage ratio than that at which they were previously forced out of business.

Ending equity ratios for the scenarios sensitive to credit policy are summarized in table 6 for a credit policy with a maximum leverage ratio of 4.0. The 4.0 leverage ratio was used because it was the least restrictive, allowing large losses in equity before forcing the operator out of business.[4] At a beginning equity ratio of .40, neither tenant nor part-owner operations were very successful in the long term. The part-owner operation appeared to maintain its initial financial position when the capital gain rate for land was seven percent per year, with a 58 percent chance that ending equity ratio will be within the .33 to .50 range. At a minus three percent capital gain rate, however, the part-owner had almost no chance of improving on the 40 percent beginning equity position, but faced a high probability (76 percent) of losing more than half of the initial equity. The tenant's ending equity ratios were much more volatile than the part-owner's, with a 38 percent chance of an ending equity ratio in excess of .50 and a 48 percent chance of an ending ratio less than .20. As with survivability, changes in capital gains had almost no effect on ending equity ratio for the tenant.

Results were much more favorable at a beginning equity ratio of .60. Chances of ending equity ratio being greater than .50 exceeded 60 percent for both tenant and part-owner and were as high as 86 percent for the part-owner when capital gain rate for land was seven percent per year. The part-owner farm operator with a .60 beginning equity ratio appeared to have a good chance of improving his or her equity position (or of at least maintaining it when capital gain rates for land were negative) providing credit policies are sufficiently liberal to allow the operator a chance to recover from a bad year.

The harshness of the 1.0 leverage ratio credit policy when beginning equity was 60 percent is borne out in examining the iterations forced into insolvency at that credit level. At a seven percent capital gain rate for land, 37 iterations were forced out in the tenant scenario (i.e., a probability of survival equal to 26 percent). Of these 37 iterations, 64 percent ended the study period below the 1.0 leverage ratio threshold.[5] Even when capital gains were minus three percent, 51 percent of the part-owner iterations forced into insolvency at the 1.0 leverage ratio finished the period with leverage ratios below 1.0 when the more liberal policy was enacted. These results suggest a 1.0 credit policy has a good chance of prematurely terminating a farm operation that would probably recover if given additional credit.

When beginning equity is 40 percent, tight credit policy appears more appropriate. As mentioned before, the part-owner has little hope of increasing equity in his or her farming operation, but stands a good chance of losing remaining equity. From these results, it appears that optimal credit policy is inversely related to beginning equity position, tightening as equity falls and being loosened as equity is increased.

A leverage ratio of 2.0 performed much better as a credit policy. When beginning equity was 40 percent and the capital gain rate was seven percent, the tenant was prematurely forced into insolvency in 38 percent of the iterations at a 2.0 credit policy leverage ratio. For the same beginning equity and capital gain rate levels, the 2.0 credit policy prematurely forced the part-owner out of business 42 percent of the time. By contrast, when the capital gain rate was minus three percent, the 2.0 credit policy forced the part-owner into premature insolvency in only two percent of all iterations. These results suggest optimal policy is also inversely related to capital gain rates for land.

Another method of illustrating the impact of different credit policies is reporting total debt

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[4] Results for other credit policies were not reported because they would be much the same as those reported for the 4.0 leverage ratio. The major difference would be that the tighter policies would prevent equity levels from falling below 20 percent, since credit would be cut off sooner.

[5] The 64 percent figure was calculated as follows: for the tenant with a .60 beginning equity ratio and seven percent capital gain rate, 36 iterations (72 percent in table 6) ended the five-year period with leverage ratios less than 1.0. Of these, 13 survived when the credit policy leverage ratio was 1.0. The remaining 23 iterations rose above 1.0 sometime during the five-year period, but were below the 1.0 leverage ratio in 1988. Therefore, 23 of 36 iterations (64 percent) were prematurely declared insolvent.

Table 6. Probability of Ending Equity Ratios[a] Falling Between Indicated Intervals for Selected Beginning Equity Positions When Required Leverage Ratio Is 4.0

Ending Equity Ratio Intervals	.40 Beginning Equity Ratio				.60 Beginning Equity Ratio			
	-3% Capital Gains		7% Capital Gains		-3% Capital Gains		7% Capital Gains	
	Tenant	Part-Owner	Tenant	Part-Owner	Tenant	Part-Owner	Tenant	Part-Owner
Above .50	38	0	38	6	72	62	72	86
Below .50 and Above .33	10	6	12	58	16	30	16	14
Below .33 and Above .20	4	18	4	22	4	6	4	0
Below .20	48	76	46	14	8	2	8	0

[a] Probabilities in the table are expressed as a percent.

Table 7. Ending Average Debt Levels for Solvent and Insolvent Iterations at a .60 Beginning Equity Ratio, Selected Capital Gain Rates, and All Credit Policies

	Leverage Ratio					
	1.0	1.5	2.0	2.5	3.0	4.0
I. Tenant						
A. 7% Capital Gain Rate						
(1) Solvent Iterations						
Percent of All Iterations:	26	58	82	86	88	92
Average Ending Liabilities($):	299,600.	317,601.	370,696.	382,543.	385,643.	402,852.
Change from Beginning($):	6,719.	24,720.	77,815.	89,662.	92,762.	109,971.
(2) Insolvent Iterations						
Percent of All Iterations:	74	42	18	14	12	8
Average Ending Liabilities($):	535,374.	620,032.	652,954.	673,729.	671,065.	825,131.
Change from Beginning($):	242,493.	327,151.	360,073.	380,848.	378,184.	532,250.
B. -3% Capital Gain Rate						
(1) Solvent Iterations						
Percent of All Iterations:	26	58	82	84	88	92
Average Ending Liabilities($):	298,995.	316,987.	370,065.	376,265.	385,068.	401,501.
Change from Beginning($):	6,114	24,106.	77,184.	83,384.	92,187.	108,620.
(2) Insolvent Iterations						
Percent of All Iterations:	74	42	18	16	12	8
Average Ending Liabilities($):	550,216.	650,534.	652,822.	655,584.	670,936.	824,981.
Change from Beginning($):	257,335.	357,653.	359,941.	372,703.	378,055.	532,100.
II. Part-Owner						
A. 7% Capital Gain Rate						
(1) Solvent Iterations						
Percent of All Iterations	74	100	100	100	100	100
Average Ending Liabilities($):	1,059,635.	1,157,124.	1,155,503.	1,155,245.	1,155,222.	1,155,222.
Change from Beginning($):	305,099.	402,588.	400,967.	400,709.	400,686.	400,686.
(2) Insolvent Iterations						
Percent of All Iterations:	26	0	0	0	0	0
Average Ending Liabilities($):	1,407,643.	–	–	–	–	–
Change from Beginning($):	653,107.	–	–	–	–	–
B. -3% Capital Gain Rate						
(1) Solvent Iterations						
Percent of All Iterations:	22	68	88	92	96	98
Average Ending Liabilities($):	857,586.	930,124.	1,021,635.	1,036,390.	1,060,056.	1,070,983.
Change from Beginning ($):	103,050.	175,588.	267,099.	281,854.	305,520.	316,447.
(2) Insolvent Iterations						
Percent of All Iterations:	78	32	12	8	4	2
Average Ending Liabilities($):	1,206,550.	1,359,569.	1,491,227.	1,592,420.	1,594,519.	1,648,532.
Change from Beginning($):	452,014.	605,033.	736,691.	837,884.	839,983.	893,996.

held by the farm operator in the last year of operation. These debt levels are particularly important to the lender, because they represent potential gains or losses to his financial institution that accompany the credit policy decision. These debt levels are reported in table 7 for both tenant and part-owner at a beginning equity level of 60 percent. The results are separated into solvent and insolvent categories to illustrate average changes in debt when the farm survives through 1988 and when insolvency occurs in or before 1988.

In every instance, average ending debt exceeded beginning debt. At a seven percent capital gain rate for land, liberalizing credit policy for tenants and part-owners resulted in ending debt for surviving iterations increasing by about $100,000, while debt for insolvent tenant iterations increased by about $300,000. Ending debt for all iterations was minimized at leverage ratios of 2.0 to 3.0 for tenants and was approximately the same across all leverage ratios for the part-owner.

The results were quite different for the part-owner when the capital gain rate was minus three percent. Liberalizing credit policy for the part-owner resulted in an average increase in debt of more than $200,000 for surviving iterations and almost $450,000 for insolvent iterations. Expected debt was minimized at a leverage ratio of 1.5. Again, tightening credit to the part-owner seems appropriate when capital gain rates are negative. The recent moves by the banking community to tighten credit in response to decreases in farmland value appear correct in light of these results.

Extension of Capital Gain Rate Scenarios

In the results reported thus far, only two capital gain rates for land have been examined. While insightful, the two rates examined hardly represent the full range of possibilities that could occur between 1984–1988. To understand the relationship of capital gains for land to farm survival, as well as the combined influences of beginning equity and credit policy on survival, four additional capital gain rates were examined for each beginning equity-credit policy combination. These rates were minus seven percent; zero percent; three percent, and 10 percent per year.

Rather than reporting and attempting to interpret results for the different beginning equity, credit policy, and capital gain rate combinations, the results were combined with those for the seven percent and minus three percent rates and then analyzed using ordinary least-squares regression techniques. The data were fit to a quadratic function because of its ease in estimation and interpretation and because the functional form is flexible in approximating the actual functional relationship. The corresponding minimum equity ratios were substituted for leverage ratios in representing credit policy, so as to facilitate comparison between credit policy and beginning equity. The estimated equations are:

$$
\begin{aligned}
S_T = \; & \underset{(16.918)}{-14.944} + \underset{(0.266)}{2.896BE} \underset{(0.0018)}{-0.0163BE^2} \underset{(0.832)}{-1.815ME} \\
& \underset{(0.01116)}{-0.00183ME^2} + \underset{(0.7303)}{0.0779CG} \underset{(0.0554)}{+0.00099CG^2} \\
& \underset{(0.01735)}{-0.000335CG^*ME} \underset{(0.0065)}{-0.000664CG^*BE} \\
& + \underset{(0.0039)}{0.01608ME^*BE}
\end{aligned}
$$

$$
\begin{aligned}
S_P = \; & \underset{(20.436)}{-49.781} + \underset{(0.367)}{3.984BE} \underset{(0.0023)}{-0.0242BE^2} \underset{(1.001)}{-1.692ME^2} \\
& + \underset{(0.0134)}{0.00111ME^2} + \underset{(0.897)}{3.365CG} \underset{(0.041)}{+0.00691CG^2} \\
& \underset{(0.021)}{-0.0228CG^*ME} \underset{(0.009)}{-0.0255CG^*BE} \\
& + \underset{(0.0052)}{0.0148BE^*ME}
\end{aligned}
$$

Where S_T = Probability of survival for the tenant, $0 \leq S_T \leq 100$

S_P = Probability of survival for the part-owner. $0 \leq S_P \leq 100$

BE = Beginning equity ratio (times 100) $0 \leq BE \leq 100$ for tenant, $0 \leq BE \leq 90$ for part-owner

ME = Minimum equity ratio (times 100), $0 \leq ME \leq 100$

CG = Percent capital gain rate

The numbers in parentheses are the standard errors for the corresponding coefficients.[6] R^2 values were .932 and .868 for the tenant and part-owner equations, respectively. Results for 100 percent beginning equity were not used in the part-owner equation because no variation in survivability occurred between this level and the 90 percent beginning equity level.

The estimated coefficients and their standard errors in both equations suggest credit policy and capital gain rate for land are linearly related to farm survival, with beginning equity apparently exhibiting a nonlinear relationship. The small coefficients for all capital gain variables appearing in the tenant equation suggest this variable had little impact on tenant survival. As noted previously, large changes in the value of land would have little impact on the tenant farmer operation since land represented only two percent of total farm assets. The interaction terms between beginning equity and credit policy were positive, implying beginning equity became more important to the farm operator as credit policy was tightened. The interaction terms between beginning equity and capital gains were negative, suggesting the value of capital gains to survival of the part-owner diminished as beginning equity increased. Alternatively, beginning equity became less important as capital gains increased.

Elasticities of survival provide additional insights into the relative influence of the three variables on farm survival. Elasticities of survival for selected beginning equity credit policy, and capital gain rate levels are given in table 8. At a 50 percent beginning equity level and three percent capital gain rate, both tenant and part-owner operations were approximately equally sensitive to changes in beginning equity for the range of credit policy options. When the capital gain rate decreased to minus three percent or beginning equity fell to 35 percent, the part-owner became more sensitive to changes in beginning equity. Similarly, both tenant and part-owner were equally sensitive to changes in credit policy, with values for the part-owner being somewhat more inelastic. Note, however, that the elasticities with respect to beginning equity were always larger than the elasticities with respect to credit policy. This result suggests survival of tenant and part-owner is more influenced by their financial position than lender's credit policy. Elasticities of survival were small for changes

Table 8. Elasticities of Survival for Tenant and Part-Owner at Selected Beginning Equity, Credit Policy, and Capital Gain Rate Levels

	Elasticity with Respect to a Change in:					
	Beginning Equity		Credit Policy		Capital Gain Rate	
Scenarios	Tenant	Part-Owner	Tenant	Part-Owner	Tenant	Part-Owner
3% Capital Gain Rate, 50% Beginning Equity, Minimum Required Equity of:						
50%	1.99	2.37	−1.09	−0.97	.002	.061
33%	1.66	1.57	−0.67	−0.50	.002	.066
20%	.92	1.18	−0.25	−0.26	.002	.067
3% Capital Gain Rate, 33% Minimum Equity, Beginning Equity of:						
35%	1.86	3.38	−1.02	−1.38	.003	.189
65%	1.10	0.93	−0.36	−0.28	.001	.034
50% Beginning Equity, 33% Minimum Equity, −3% Capital Gain Rate	1.68	1.94	−0.67	−0.49	−.002	−.071

---

[6] Candler and Cartwright state: "In a non-stochastic [simulation] model, the standard errors obtained from least-squares regression have no meaning." In fact, standard errors from simulated data may provide some indication as the strength of fit for each coefficient, but cannot be used in conjunction with t-tables to test for significance.

in the capital gain rate, although changes in beginning equity resulted in relatively large changes in elasticity.

Summary and Implications

The principal objective of this paper was to examine the effects of beginning equity, credit policy, and capital gain rates for land on the survivability and ending equity position of a representative Texas rice and soybean farm. Beginning equity was the predominant variable of the three in determining whether the farm operator will survive the next five years. Both tenant and part-owner operations were much more sensitive to changes in beginning equity than they were to changes in credit policy or capital gain rate for land.

Credit policy is only important to farmers at intermediate beginning equity levels. At high beginning equity levels, both part-owners and tenants survive regardless of the credit policy. At low beginning equity, neither type of farm operation will likely survive, no matter how liberal the credit policy. This result holds particularly for the part-owner operations, which offer little promise of improving on beginning equity position but do invite a high probability of sliding into a very deep debt situation. Tenant operations, while presenting a greater risk of losing all remaining equity, also offer a higher probability of improving on the beginning equity situation than do the part-owner operations.

Performance of the part-owner versus tenant operations is closely tied to the capital gain rate for land. A high rate causes part-owner operations to perform much better than tenant operations, even at low beginning equity levels. At negative capital gain rates, however, part-owners are much more dependent than are tenants on beginning equity for continued farm survival. Tightening credit seems appropriate when capital gain rates are negative.

Results for the representative farm suggest a credit policy leverage ratio of 1.0 is too restrictive, because it forces farm operations into insolvency that would probably recover if given a chance. A credit policy of 4.0, on the other hand, is probably too lax because it allows farm operators in a high debt position to continue farming, even though there is little chance the operators can achieve an acceptable equity position. The 2.0 leverage ratio appears to offer lenders a reasonable credit policy alternative, liquidating farm operations with little hope of recovery from financial trouble but permitting sufficient credit to allow recovery from bad years.

It is not known, of course, how representative these results are for farms across the country. If they are somewhat representative of the national situation, however, the results suggest a very real crisis for U.S. agriculture. According to a recent survey, 32 percent of bank farm customers have equity ratios of less than .40, with an additional 29 percent having equity ratios between .40 and .60 (Doane Publishing). Given the results from this study, several recommendations can be made: (a) any proposed debt relief program should be targeted, because farm operators in a low debt position simply do not need assistance; (b) given the current course of events, nothing short of a massive buy-down of debt or large increases in capital gain rates on land will save farm operators in a high debt situation from insolvency; and (c) because declines in land value (i.e., a negative capital gain rate) are partly responsible for the current debt crisis, policies aimed at halting or reversing this decline may prove as effective as current proposals in dealing with the debt crisis. In this light, it is ironic to note the move to slash farm subsidies currently in vogue among government policymakers. Because of low farm prices over the last few years, the target price has become the expected return to the farmer. A cut in the target will not only reduce farm income but will cause land values in some areas to further erode, causing the debt crisis to become even more severe in those areas.

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Machinery Lease Versus Purchase Decisions Under Risk

Glenn D. Pederson

Abstract

Recent changes in tax treatment of financial leases and the cost of debt financing have altered the incentives to lease machinery. Conventional lease versus purchase analyses have not considered risk associated with fluctuating taxable income (hence, tax benefits under each financing alternative) and changing interest rates. A simulation model was developed to evaluate the distribution of net present costs under various taxable income-interest rate scenarios. Results indicate that fluctuation of taxable income, interest rate movements, and risk preferences of lessees alter the preferred financing alternative.

Key words: leasing, risk, taxes, simulation

Farmer interest in machinery, equipment, and structure leasing has developed for three reasons. First, tax law changes altered the financial incentives to lease. The Economic Recovery Act of 1981 (ERTA) and the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) changed the definition of a financial lease, use of depreciation allowances, use of investment tax credit, and transferability of tax benefits through leasing. Second, use of leasing increased in response to higher, more variable interest rates. Farmers who needed to acquire additional machinery sought financing alternatives other than additional debt. Third, rising machinery and equipment costs placed additional pressure on available cash flow, leaving little to meet the down payment requirements on new assets. A financial lease is a potential means of acquiring additional machinery capacity with a reduced initial cash requirement.

Previous studies have considered the potential advantages and disadvantages of financial leasing (LaDue, 1982; Plaxico, Walsh). Potential advantages include altered cash flow timing, improved working capital position, and improved tax treatment through transfer of tax benefits. Potential disadvantages are relatively higher cost associated with some leasing arrangements, problems of anticipating what asset residual values will be at lease termination, and the fixed nature of a financial lease obligation. Prior studies have recognized that most leasing arrangements are tax motivated. Situations in which leasing is viable are expected to involve individuals and businesses that do not have identical tax brackets or costs of capital. Differing tax rates can result in advantages to leasing even when both parties are able to utilize available tax deductions and credits.[1]

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Lease versus purchase analyses typically have utilized a cash flow approach (Schoney and Massie; LaDue, 1977; LaDue, 1979; Willett and Penland; Schoney). Conventional cash flow analysis can follow either of two methodologies. One can estimate the after-tax present value cost difference between the lease and purchase and accept the alternative which generates a cost savings. Alternatively, the model may be formulated to solve for the after-tax, interest cost equivalents of the loan and lease (Wyman).[2] The rate equivalent for the lease then could be compared with that of the loan or the firm's after-tax cost of term debt. Leases which result in financing rates higher than the equivalent rate on debt could be rejected, other factors held constant.

Conventional capital budgeting analyses have concentrated on analyzing mean cash flows. Riskiness of cash flows has been implicitly recognized by incorporating a risk premium in the discount rate (risk-adjusted discount rate). Three potential problems with this approach are worth considering. First, use of a risky discount rate employs the specific assumption that risk premiums change annually at the same rate as present value factors adjust over time, holding the risky discount rate constant. Second, a risk-adjusted discount rate yields only a point estimate of project profitability. Decision makers may be sensitive to the distribution of present value outcomes. Parameters of the present value distribution are not forthcoming from conventional analysis unless additional assumptions are made about the distribution of risk premiums for the investor. Third, determination of an appropriate risk premium is, itself, a significant problem. Use of a market interest rate as a proxy for the risky discount rate may reduce the applicability of the results if there is a lack of correspondence between the market risk premium and the individual's risk preferences.

Anderson et. al. suggest that naive models (such as the risky discount rate approach) should not be used and that three other analytical approaches are preferrable. Those three approaches are (a) multidimensional utility appraisal of risky cash flow sequences, (b) mathematical programming, and (c) utility appraisal of net present value distributions using risk efficiency criteria.[3] Ranking net present value distributions using the axioms of expected utility theory requires that certain capital market assumptions be made to render the analysis theoretically correct.[4] Other agricultural research applications have employed simulation and risk efficiency tools for ranking investment alternatives based on net present value measures (Boggess and Amerling).

This paper approaches the decision to lease or purchase farm machinery by explicitly modeling risky cash flows over time. These risky annual flows are discounted using a risk-free rate to avoid double-counting for risk. The limited objective of this paper is to evaluate how taxable income and interest rate fluctations during the investment period influence the financing choice for certain classes of decision makers. Subsequent sections of the paper explore various components of risk, describe the simulation model that was developed, and review the rankings of financing choices under risk.

Risk Components

Financial leases are long-term arrangements between a lessor (leasing company, financial institution, or equipment dealer) and a lessee (farmer). The benefits of leasing are subject to change as a farmer's financial and

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[1] Dunn and Watts demonstrated that advantages to leasing exist if the lessor is in a higher tax bracket than the lessee. The benefits of the leasing transaction derive from the sequence of fixed costs, accelerated depreciation allowances, and utilization of the investment tax credit.

[2] A lease transfers significant tax benefits of ownership to the lessor; the farmer's tax position under a lease will differ from that which would result with a purchase. As a consequence, annual percentage rate (APR) comparisons between lease and purchase financing costs can be misleading. The APR is a before-tax interest rate concept and should be utilized only when comparing leases or comparing loans which are subject to similar tax treatment.

[3] Anderson et. al. argue that the multidimensional (state-time preference) utility approach is the only one which is valid. However, due to its complexity the authors suggest that simulation of net present value distributions and use of risk efficiency tools for evaluation of alternatives is acceptable.

[4] It is highly unlikely that capital markets perform according to the perfect capital market assumptions (perfectly competitive, zero transaction costs, complete and costless information, and equivalent rates on borrowed and loaned funds).

tax positions change over the life of the lease or loan transaction.

Fluctuating taxable income directly influences the cost of lease and loan financing alternatives by increasing or diminishing their tax benefits and net, after-tax financing costs. Tax benefits for lessees include lease payment deductions, while tax benefits of ownership include interest payment deductions, depreciation allowances, and availability of the investment tax credit.

As taxable income varies above its expected level, tax benefits increase and net, after-tax financing costs decrease. Due to progressive graduation of the income tax, however, the potential tax savings associated with deductibility of ownership or leasing costs will vary depending on the direction of change in income. That is, the increase in taxes associated with an increase in income of a given magnitude will be greater than the reduction in taxes due to a decline in income of the same magnitude, other factors held constant. The availability and use of tax benefits under the loan and lease alternatives will modify the related distributions of financing costs as incomes fluctuate over time. Progressivity of the income tax and ability to carry over unused tax benefits (or net operating losses) may well lead to redistributions of financing costs which are difficult to incorporate when using a nonstochastic method of analysis. The resulting distributions of net, after-tax financing costs may be significantly nonnormal, creating a problem for the investor who is not risk-neutral.

Financial institutions are using adjustable interest rates on farm loans to reduce their interest rate risk exposure. The resulting interest rate variability takes on additional significance in the lease versus purchase decision, since lease rates are usually fixed over the financing period and loan rates are periodically adjusted to reflect current market interest rates. The preferred financing alternative is potentially altered by the direction and magnitude of future interest rate movements and their differential impacts on debt and leasing costs.

The residual value of the asset represents a potentially important source of risk in addition to taxable income and interest rate variability. For example, if the cost of a machine increases over the life of the lease, the residual value also is expected to increase. When this increase is not anticipated the farmer will pay a higher-than-expected amount to purchase the asset for its remaining useful life under a fair market value purchase option. A farmer can limit or eliminate residual value risk through the use of a fixed price purchase option.[5]

The Simulation Model

A mathematical simulation model was formulated to analyze the farmer's lease versus purchase decision under risk. The model was developed as a conventional capital budgeting analysis with refinements to incorporate current tax law provisions and randomness of taxable income. The conventional discounted cash flow formulation can be mathematically expressed for the purchase (with a loan) and lease alternatives. The net present cost (NPC) of the purchase is:

$$\text{NPC (loan)} = D_0 + \sum_{m=0}^{M} \frac{D_m}{(1+r)^m} - t \sum_{m=0}^{M} \frac{(A_m + I_m)}{(1+r)^m} - \frac{C_q}{(1+r)^q} \quad (1)$$

where, D_0 = cash down payment
D_m = debt repayment (principal and interest) in period m
t = marginal tax rate
A_m = depreciation taken in period m
I_m = interest payment in period m
C_q = investment tax credit in period q
r = discount rate
m = period (in years)

Annual reductions in outflows (due to reduced taxes) are deducted from annual cash outflows to derive the net, after-tax flows. These flows are then discounted to compute the appropriate net present cost. Similarly, the net present cost of the lease is:

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[5] The option to purchase the asset at lease termination for a price which is known in advance effectively eliminates residual value risk as a major source of risk for the farmer (lessee), and is not considered as part of this study. In effect the risk of changing residual value is shifted to the lessor, who may in turn adjust the lease rate to include a residual value risk premium.

$$\text{NPC (lease)} = \sum_{n=0}^{N} \frac{LP_n}{(1+r)^n} + \frac{S_N}{(1+r)^N} - t\left(\sum_{n=0}^{N} \frac{LP_n}{(1+r)^n} + \sum_{m=N+1}^{M} \frac{R_m}{(1+r)^m}\right) \quad (2)$$

where, LP_n = annual lease payment in period n
S_N = amount of purchase option in period N
R_m = depreciation allowance in period m associated with the lease purchase option
n, m = periods (in years)

Cash outflows of the lease are lease payments and the fixed price purchase at lease termination. Corresponding reductions of outflows include the stream of tax benefits due to deductibility of lease payments and depreciation (if the leased asset is purchased).[6]

Tax benefits and net present costs of leasing and purchasing are uncertain if interest rates, taxable incomes, and therefore, tax rates, are random. The model expressed by equations 1 and 2 is modified to include uncertain tax benefits and variability of interest payments, as shown in equations 3 and 4.

$$N\tilde{P}C\ (\text{loan})_k = D_o + \sum_{m=0}^{M} \frac{\tilde{D}_m}{(1+r)^m} - \sum_{m=0}^{M} \frac{\tilde{t}_m (A_m + \tilde{I}_m)}{(1+r)^m} - \frac{C_q}{(1+r)^q} \quad (3)$$

$$N\tilde{P}C\ (\text{lease})_k = \sum_{n=0}^{N} \frac{LP_n}{(1+r)^n} + \frac{S_N}{(1+r)^N} - \left(\sum_{n=0}^{N} \frac{\tilde{t}_n LP_n}{(1+r)^n} + \sum_{m=N+1}^{M} \frac{\tilde{t}_m R_m}{(1+r)^m}\right) \quad (4)$$

where, $\tilde{D}_m$ = uncertain debt repayment in period m
$\tilde{t}$ = random tax bracket
k = the observation of the random net present cost

The discounted cash flow framework under risk which is described by equations 3 and 4 forms the basis for the simulation model to evaluate farmer preferences for leasing or purchasing depreciable assets.

An interactive simulation program was developed to generate a quasirandom sequence of taxable incomes. Taxable incomes were simulated based on estimated historical distribution parameters that are representative of North Dakota cash crop operators during 1981–1983 (Pederson, et. al.). Although the historical distribution estimates indicated large variability and significant right-tail skewness for all farms, these parameters were modified for simulation purposes. Only the range (minimum taxable income through the 95th percentile) was utilized.[7] Upper and lower bounds of the taxable income distributions were set three standard deviations from the assumed mean as shown in table 1. A Beta distribution was used to generate the random taxable income sequences, since it is sufficiently flexible to replicate symmetric (or nonsymmetric) distributions.

Taxable income distributions were paired with specific machinery costs to represent financing situations that are considered representative of various actual investment situations (table 1). Machinery costs are representative of various sizes of farm tractors for which new costs vary from $51,000 for a 135-horsepower, two-wheel-drive tractor to $130,000 for a 300-horsepower, four-wheel-drive tractor. The simulation model was used deterministically to identify mean taxable income levels at which the after-tax financing costs of the loan and lease alternatives are sufficiently close to merit a risk analysis. All model parameters were held fixed while a constant (over the period of analysis) taxable income was systematically adjusted until the net, after-tax financing costs of the two financing

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[6] Specification of equations 1 and 2 jointly imply incremental cash flows for the lease alternative. The planning horizon for the lease is necessarily extended to capture the tax benefits associated with purchasing the asset at the end of the lease contract period. A facilitating assumption was made that the investment (in this case a tractor) has a minimum useful economic life of 10 years.

[7] Taxable incomes derived from 660 farm business summaries were statistically analyzed. The adjusted mean taxable income was $14,273 (after taking the standard deduction for a family of four and making adjustments for IRA contributions, but before use of the investment tax credit) for operators with taxable incomes above the minimum (zero-bracket) level of $3,400. The median taxable income was $8,988 and the 95th percentile was $47,216. Farmers above the zero-bracket level represented approximately 23 percent of all farms which were analyzed.

Table 1. Taxable Income-Machinery Cost Scenarios

Scenario	Machinery Cost	Expected Taxable Income	Standard Deviation of Income	Income Bounds	
				Lower	Upper
I	$ 51,000	$13,650	$3,416	$3,400	$23,900
II	76,500	18,450	4,610	4,620	32,280
III	130,000	28,450	7,106	7,130	49,770

alternatives were approximately equal. Other parameters of the taxable income distribution were subsequently set based on somewhat arbitrary assumptions about the magnitude of income variability.

The stochastic simulation model was used recursively to randomly draw sequences of taxable income for the lease and purchase net present cost computations. The model produced 100 iterations to generate a distribution of net present cost for each alternative under each set of model assumptions. The frequency distributions of net present costs were derived and summed over the range of outcomes to generate separate cumulative distributions for the lease and purchase financing alternatives. Cumulative distributions were ranked for classes of decision makers with different risk preferences using stochastic dominance with respect to a function.[8]

Three interest rate environments were evaluated using the model. Interest rates were allowed to vary deterministically, not as random variables in the simulation model. All three interest rate environments were based on average annual loan rates charged on machinery by a representative Production Credit Association between 1973 and 1981. The constant interest rate environment assumes rates hold constant at 12.8 percent. The rising interest rate environment allows the annual rate to increase by one percent per year from 12.8 percent in the initial year to 16.8 percent in the fifth year of the loan. The falling interest rate environment allows the annual rate to fall one percent each year from 12.8 percent to 8.8 percent in the fifth year of the simulation.

The lease was structured as a fixed-rate contract. Lease rates vary considerably, therefore, lessors that offer both leases and loans were contacted to determine what terms are representative of farm machinery leases. Responses indicated that lease rates are typically set at two to two and one-half percent spread over initial interest rates on loans of equal maturity. The before-tax lease objective was, therefore, set at 2.2 percent over the initial loan rate (or 15 percent) for all simulations.

In all simulations the lessor was assumed to take the investment tax credit and depreciate the leased asset using accelerated cost recovery rates. The fixed purchase price option under the lease was set at 15 percent of the original cost of the asset. The down payment requirement under the loan was held at 20 percent of the initial cost. Use of debt was not considered under the lease at the time of the buyout.

A riskless discount rate was used to discount project cash flows in all simulations. The average one-year Treasury bill rate between 1977 and 1983 (9.6 percent) was used (Federal Reserve). The average T-bill rate was adjusted downward by the marginal tax rate in each period of the analysis to approximate an after-tax, risk-free rate.

Simulation Results

Summary statistics for the lease and purchase cost distributions are shown in table 2. Mean net present costs of the lease and purchase distributions were nearly equal in all scenarios which assumed constant interest rates (panel A). The small mean value difference reflects the similarity of the lease and loan terms specified in the model and the fixed interest rate loan assumption initially employed in the analysis. Standard deviation was more than twice as great for the purchase alternative due to the relatively

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[8] Stochastic dominance with respect to a function allows the decision maker to rank risky alternatives through a pairwise comparison of cumulative probability distributions given the assumption of constant absolute risk aversion over a defined set of payoffs (Meyer).

Table 2. Summary Statistics of Net Present Cost Distributions For Three Taxable Income-Machinery Cost Scenarios and Selected Interest Rate Environments

Taxable Income-Machinery Cost Scenario	Financing Alternative	Mean	Standard Deviation	Skewness
	Panel A (Constant Interest Rates)			
I	Lease	$ 45,203	$ 747	.406
	Loan	45,585	1,690	.163
II	Lease	$ 65,313	$ 944	.124
	Loan	65,647	2,576	.058
III	Lease	$103,476	$2,183	.135
	Loan	103,231	5,653	−.176
	Panel B (Rising Interest Rates)			
I	Lease	$ 45,203	$ 747	.406
	Loan	47,078	1,705	.115
II	Lease	$ 65,313	$ 944	.124
	Loan	67,840	2,594	−.023
III	Lease	$103,476	$2,183	.135
	Loan	107,198	5,651	−.157
	Panel C (Falling Interest Rates)			
I	Lease	$ 45,203	$ 747	.406
	Loan	44,195	1,712	.101
II	Lease	$ 65,313	$ 944	.124
	Loan	63,475	2,583	.042
III	Lease	$103,476	$2,183	.135
	Loan	99,705	5,652	−.068

greater importance of ownership tax benefits in reducing financing costs when incomes were allowed to fluctuate. The standard deviation is a useful statistic for identifying the preferred financing alternative when the underlying distribution of present costs is approximately symmetrical.

Skewness statistics indicated that the simulated cost distributions were not symmetric about the mean under any of the taxable income-machinery cost scenarios. Most distributions exhibited positive (right-tail) skewness with the lease exhibiting the greatest positive skewness in all three scenarios. The primary reason for the different shapes of the distributions was the disparity between the utilization of tax benefits as taxable income fluctuated. When taxable income randomly fluctuated above the mean income level, tax benefits increased proportionately for both the lease and loan distributions. However, when taxable income fluctuated below the expected level some or all of the available tax benefits were not used because tax liability was less than available tax benefits. Unused tax benefits (lease payments, interest, and depreciation) were carried forward to subsequent years as annual net operating losses. Excess investment tax credit was also carried forward. The present value of tax benefits carried forward was, of course, lower due to discounting. The necessity of carrying benefits forward in low income years had a relatively greater impact on the loan financing alternative which had somewhat larger annual tax benefits.

The net present cost distributions were ranked for decision makers with different risk preferences under three interest rate environments as shown in table 3.[9] Rankings

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[9] Coefficients of absolute risk aversion used in the stochastic dominance analysis were selected based on prior studies of farmers' risk preferences. The coefficient bounds were set for three classes of decision makers as follows: (a) risk-averse (0., .002), (b) risk neutral (0., 0.), and (c) risk-preferring (−.0002, 0.).

Table 3. Preferred Financing Choices For Alternative Interest Rate Environments

Taxable Income-Machinery Cost Scenario	Risk-Averse	Risk-Neutral	Risk-Preferring
	Panel A (Constant Interest Rates)[a]		
I	Lease	Lease	Lease
II	Lease	Lease	Indifferent
III	Indifferent	Loan	Loan
	Panel B (Rising Interest Rates)		
I	Lease	Lease	Lease
II	Lease	Lease	Lease
III	Lease	Lease	Lease
	Panel C (Falling Interest Rates)		
I	Indifferent	Loan	Loan
II	Indifferent	Loan	Loan
III	Indifferent	Loan	Loan

[a] Corresponding statistical estimates for the constant interest rate net present cost distributions are shown in table 2.

with constant interest rates (panel A) indicated that the lease financing alternative would be selected by risk-neutral farmers under Scenarios I and II, but the loan would be preferred under the high income-high machinery cost scenario (III). The risk-neutral class of farmers would rank highest the alternative which yields the lowest mean cost (mean dominance). The risk-averse class of farmers would rank the lease alternative first under Scenarios I and II, but would be indifferent between the two choices under Scenario III. The reason for this indifference in Scenario III is reflected in the lower mean cost and negative skewness (which favor the loan), and the correspondingly higher variability of those costs under the loan (which favors the lease alternative). Risk-preferring farmers (as a class of decision makers) demonstrated no consistent preference for the loan or lease alternative due to changes in the parameters of the underlying cost distributions. The lower mean costs with the lease in Scenario I compensated risk-preferrers for the loss of probability at lower cost levels (left-tail). Lower mean costs, larger variability, and negative skewness of the cost distribution all made the loan the preferred alternative for risk-preferring farmers in Scenario III.

Simulation results for the rising interest rate environment (panel B) indicated that a wide risk class of farmers would prefer the lease over the loan. The primary reasons for this preference were the lower mean costs and lower relative variability under the lease financing alternative. The major effect of rising interest rates was to raise the mean costs of the loan without appreciably changing the associated standard deviation. Higher mean cost in the rising interest rate environment reflects the combined effects of higher interest costs and limited deductibility of those increased financing costs from the same sequence of random taxable incomes.

A falling interest rate environment reversed the ranking of financing alternatives. Falling interest rates reduced the combined mean costs without significantly affecting variability under the loan financing option. The decline of interest rates over the life of the loan reduced the probability of high cost levels. The shift of probability to the left tail of the cost distribution is apparent in Scenarios II and III due to lower annual interest costs relative to the level of taxable income. The class of risk-averse farmers would have difficulty ranking these two financing choices as reflected by the uniform indifference shown in panel C over all taxable income-machinery cost scenarios.

Conclusions

Prior research indicates that financial leasing has become a relatively more attractive financing alternative for farmers due to recent changes in tax laws and economic conditions. Previous studies of the lease versus purchase decision have not adequately incorporated risk factors into the cash flow analysis. This paper presented a simulation model and results which included risk associated with taxable income variation and changing interest rates. Simulation results illustrated that these factors can significantly alter the distribution of costs and potentially alter the preferred financing alternative. The reported risk analysis was based on specific taxable income distribution-machinery cost scenarios within which the two financing options were roughly equivalent in terms of present value of costs. In this framework the comparison of financing options within the constant interest rate environment was more heavily influenced by distributional characteristics other than the mean costs generated by each alternative. The simulation model is a useful tool in analyzing how sensitive selected financing alternatives are to different terms and risk factors.

Two additional sets of conclusions were drawn from the analysis. First, a conventional capital investment analysis of mean cash flows may provide sufficient information for farmers to select the least-cost financing alternative. A large number of taxable income-machinery cost combinations could be identified which would not be sufficiently close to warrant a risk analysis. A conventional analysis would require less information and produce sufficient results on which to base a financing decision.

Second, preferred financing alternatives were identified using assumed risk preferences for risk classes of decision makers. No clear pattern of preference was identified for risk-averse or risk-preferring classes of farmers. Greater diversity in selection of a financing option was illustrated when loan interest rates were held constant over the life of the loan. When loan interest rates were allowed to steadily adjust upward the lease was generally preferred due to mean dominance of the associated cost distribution. The simulated variable rate loan was ranked equivalent to, or preferrable to, the lease when interest rates were allowed to steadily decline. The preferred financing alternative significantly depends on a farmer's expectations of future interest rate movements in addition to the expected tax position. When considering a fixed rate lease versus a variable rate loan to finance the purchase of farm machinery, equipment, or structures, the future course of interest rates potentially far exceeds variations in taxable income and is a critical factor to evaluate in the analysis.

Some important limitations to the simulation analysis should be considered. First, the underlying distribution of taxable income is not known, although the parameters of that distribution were set based on recently analyzed farm income data. Second, assumptions about the lease arrangement (lessor tax rate, lease yield objective, and resulting lease payments) were not varied within income-machinery cost scenarios. Lease characteristics which were modeled are representative of current lease contracts. Yet, farmers are able to lease machinery and equipment from a wide range of lessors whose lease arrangements and terms vary from those employed in this study. Finally, the model assumed a fixed price purchase option which was less than the market value of the asset at lease termination. Although this is a typical situation of farm financial leases it is not representative of fair market value leases. Additional research needs to focus on the impact of residual value risk.

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Effects of Selected Macroeconomic Policies on Agriculture: 1984–1990

Dean W. Hughes and John B. Penson, Jr.

Abstract

This paper describes the likely financial implications for farmers if three different macroeconomic policies are pursued to the end of the decade. The scenarios studied are intended to aid in identifying the causes of current financial difficulties in the sector rather than as forecasts of the future. Two of the scenarios assume continuing large government budget deficits. In both, financial conditions for farmers continue to deteriorate. An expansionary monetary policy, without deficit reductions, provides only a brief respite from current problems. Substantial improvement could be expected, however, if deficits are reduced and a moderate monetary policy is pursued.

Key words: farm finance, monetary policy, fiscal policy, projections of farm sector conditions, government deficits, inflation.

Farmers and ranchers continue to suffer through the longest and most severe recession in 50 years. Legislators are currently debating measures aimed at alleviating the financial stress being experienced by highly leveraged farmers. Work is also underway in formulating the 1985 farm bill. These discussions are taking place in a time of great political uncertainty; the future course of monetary and fiscal policy, for example, is a much debated issue. The time is certainly right, therefore, to look ahead to the effects that alternative macroeconomic policies will have upon the financial future of the U.S. farm sector.

The purpose of this paper is to present projections of financial conditions in the farm sector to the year 1990 under alternative macroeconomic policies. These projections are made using COMGEM, a commodity-specific general equilibrium model of the U.S. economy that places particular emphasis on agriculture. COMGEM has been used in the past to examine macroeconomic linkages between agriculture and the rest of the economy (Penson; Hughes and Adair) as well as in policy analysis and current situation and outlook work at the U.S. Department of Agriculture. An overview of this model's structure is presented in Penson, Hughes, and Romain. Due to the uncertainties attached to political and other noneconomic factors, the results presented in this paper should be considered as projections of what farm sector financial conditions would be *if* specific macroeconomic policies are pursued. *They should not necessarily be construed as forecasts of what the future will bring.* It is likely, for example, that policies as stressful to agriculture as some developed in this paper would lead to compensatory government policies which are impossible to

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predict at this time. Finally, every effort has been made to avoid making subjective evaluations of the likelihoods associated with different outcomes. Such evaluations are more in the realm of the study of politics than economics and are left to the reader.

The first section of the paper presents a brief outline of current financial conditions in the sector and the major forces that have brought them about. The next section presents projections of future financial conditions in the sector under three distinctly different sets of macroeconomic policies. The final section summarizes the paper.

Past and Current Financial Conditions in the Farm Sector

The last comprehensive long-term projections of future financial conditions in the farm sector were made back in 1979 and 1980 (Moore, et al.; Hughes, 1981). At that time, farm income had been high for almost a decade and farm real estate values nationally had increased for 25 consecutive years. The major concern at that time was the continued low current returns to farm assets. Inflation was high and growing, squeezing net farm incomes through rising production costs. However, it was also generating substantial unrealized capital gains in farm real estate.

With the concerned yet decidedly optimistic attitudes of that time, it is little wonder that these projections missed the harsh realities of the next five years at least in degree, if not in direction. Net farm income in 1980 through 1983 averaged 10 percent less than it did in 1976 through 1979. In constant dollar terms, the decline was worse, with the average falling by one-third between these two periods. Farm real estate values declined in both real and nominal terms. By the end of 1983, farm real estate values were 23 percent below their peak in real dollars and seven percent below their peak in nominal terms. Even farm debt, which continued to grow during the 1980–1982 period because of debt repayment problems, declined in 1983 by more than $2 billion.

The seeds of current problems had been planted prior to the start of 1980, however. The announcement of a change in the operating policies of the Federal Reserve System in late 1979 was, in retrospect, a clear signal of a new offensive against inflation. Hindsight suggests that the inherent conflicts among the fiscal policies proposed by the current administration in the early 1980s should have been clear. Plans to simultaneously reduce taxes, increase defense expenditures, and balance the budget were inconsistent and unachievable. In addition, the conflict between the resulting highly stimulative fiscal policy and a restrictive monetary policy that reduced inflation from 9.2 percent to 4.3 percent in three years is reflected in the historically high real interest rates observed during the 1980s. On an ex post basis, real interest rates on Production Credit Association (PCA) loans averaged 2.1 percent from 1976 through 1979 as opposed to 6.3 percent from 1980 through 1983. On an ex ante basis, the change may have been even greater, given expectations of rising inflation prior to 1979 versus the flat to declining expectations of future inflation today.

Net farm incomes and farm asset values have been strongly influenced by these high real interest rates. Farming is one of the few businesses in the nation that is sensitive to both interest rates and export demand. Rising interest rates influence net farm income in several ways (Hughes and Adair). The most direct impact is to increase interest expenses associated with servicing the over $200 billion in outstanding farm debt. Another important impact is the influence that higher interest rates have on farm revenues through the level of prices farmers receive. Higher real interest rates in the U.S. induce foreign investment in U.S. securities. To buy these securities, foreigners need more dollars. This bids up the value of the U.S. dollar relative to the value of other currencies.[1] A stronger U.S. dollar translates into an increase in the cost of U.S. agricultural exports, which reduces foreign demand for these products. Higher U.S. interest rates may also have precipitated a crisis in Third World countries that have been borrowing to finance both capital and human development. Their current debt repayment problems have forced them to reduce their imports of U.S. farm products.

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[1] There are, of course, other factors that also explain a higher value of the U.S. dollar. These include: lower inflation in the U.S. relative to other currencies and, to some extent, political uncertainties in foreign countries.

Added to these declines in foreign demand, a decline in domestic demand has resulted from reduced growth in consumer incomes and higher inventory carrying costs. Thus, farm prices and net farm income have been hurt by the high interest rates caused largely by conflicts between monetary and fiscal policies.

Farm asset values in the 1980s have also suffered from these high interest rates. The profitability of investing in farm assets has declined at the same time the cost of borrowing has increased. The combination of these two factors has led to an almost catatonic land market in many regions of the country and raised concerns of possible price declines below long-term equilibrium levels.

Since the middle of 1983, the general economy has seen a period of vigorous growth. This growth has had little effect on the financial condition of farmers, however. Real GNP grew at an annualized rate of more than six percent in the second half of 1983 and is expected to grow between six and seven percent in 1984. Yet net cash farm income in 1983, even with the Payment-in-Kind program, was not substantially higher than the levels observed in 1981 and 1982; nor is it expected to be in 1984 or 1985.

It might seem a contradiction to argue that macroeconomic policies have caused the decline in farm profitability, and yet not to expect improved macroeconomic conditions to help the sector. The reason for this is that macroeconomic policies are responsible not only for the size of the economic pie, but also for partially determining the size and distribution of its slices. A given level or rate of growth in real GNP can be accomplished by an infinite number of combinations of fiscal and monetary policies. Each combination, however, will generate different levels of interest rates, consumption, investment, and savings.

Current conflicts between monetary and fiscal policies have a definite bias against interest rate sensitive and export sensitive industries. Since agriculture is sensitive to both variables, financial resources are flowing out of the sector to finance nonfarm activities. Financial resources are fluid, and generally lead eventual adjustments in physical resources. During 1981 and 1982, the entire economy was struggling through the worst recession since the Great Depression. While farmers were having difficulties, they at least knew they were not alone. Since mid-1983, however, profitability has returned to many other sectors in the U.S. economy. Capital has been flowing into these sectors to meet their growing demands. These flows have helped keep real interest rates high and thus have postponed any recovery in the farm sector.

Substantial problems currently exist in farm loan markets. Surveys show two to three times the normal proportion of farmers are leaving the sector, either voluntarily or through forced sales (Federal Reserve Bank of Kansas City and Federal Reserve Bank of Chicago). Farm loan losses at banks and the Farm Credit System have grown dramatically (Melichar, Irwin). Delinquencies at the Farmers Home Administration now exceed 30 percent.

In short, the current financial health of the farm sector can be characterized as poor. Constant dollar incomes have been low for five consecutive years, asset values are declining, and debts are overdue.

Projections of Future Financial Conditions in the Farm Sector

Policy prescriptions are being formulated in response to these problems. To create policies that do more than simply react to past conditions, we need to know more about future economic conditions in the sector. Little will be gained by implementing policies that simply postpone adjustments if these adjustments will in all likelihood be required in the future. In fact, harm can be done if government intervention eventually compresses these adjustments into a shorter time period.

Three projections of the future are presented in this section. The first scenario assumes an adherence to expansionary fiscal policies and restrictive monetary policies (i.e, the EFRM scenario). Such policies would be reflected in continued high government deficits and a slow growth in the money supply to fight against inflation. Current inflation is still between four and five percent (a level that was high enough to trigger the Nixon Administration's price and wage controls in the early 1970s). Thus, it is not difficult to imagine continued slow growth in money and credit. The second scenario assumes an adherence to expansionary monetary and fiscal policies (i.e., the EFEM scenario). These policies lead to continued high deficits, but a faster growth in the money supply. Past history reveals that periods of slow economic growth and low inflation are often followed by periods of rapid growth and higher inflation. Moreover, the continued fight against inflation by restrictive monetary policy (assumed in the first scenario) could be curtailed by a potential collapse of international financial markets. Finally, the third scenario assumes an adherence to a restrictive fiscal policy and a moderate monetary policy (i.e., the RFMM scenario). These policies would lead to decreases in the budget deficit and a money supply which falls between those given by the restrictive monetary policies in the EFRM scenario and the expansionary monetary policies in the EFEM scenario. The RFMM scenario represents an admittedly optimistic view of the future, but one which has some chance of occurring.

No attempt is made to out-guess farm policymakers in these scenarios. Farm policies are identical across all three scenarios; each reflects 1984 levels of support, excluding the delayed impact of the 1983 Payment-in-Kind program. No surprises in either energy prices or weather are assumed in these scenarios, although some shocks are likely to occur over the remainder of this decade.[2]

EFRM: High Deficits and Slow Growth in Money

The annual government budget deficit in this scenario is held at its 1984 level in real terms through 1990. Monetary policy is constructed to eliminate inflation by 1987, and then hold changes in the overall price level to near zero. It is, of course, highly unlikely that the smooth transition projected for the economy in this scenario could actually be achieved. Eliminating inflation would probably introduce more volatility in the economy than the model results indicate. However, the implications for the farm sector of another period of disinflation in the face of large government deficits are clearly indicated in COMGEM's projections.

Events in the general economy. Stopping inflation in the face of continued fiscal stimulus is projected to lead to another period of slow growth and higher real interest rates for the general economy. The solid lines in panels a to c of figure 1 illustrate the trends in the percent change in real GNP, the percent change in the implicit GNP price deflater, and the real prime interest rates suggested by this scenario. Growth in real GNP, which averages 2.3 percent from 1985 to 1990, is substantially below the economy's long-run potential growth rate which is normally assumed to be about three percent. Inflation is smoothly controlled by 1987, after which the implicit GNP price deflater does not change by more than 0.2 percent annually. The real prime interest rate continues to grow throughout the period, reflecting both the continuing conflict between fiscal and monetary policy and the adjustments taken by financial intermediaries to higher costs of loanable funds.

Implications for the farm sector. The effects of continued slow growth in incomes and even higher real interest rates on the farm sector are clear: (a) lower net farm incomes, (b) declining asset values and (c) restricted use of debt financing. Panels a to c in figure 2 graphically illustrate these trends. The solid lines once again represent results from the EFRM scenario. Net farm income expressed in 1967 dollars fluctuates between $5 and $12 billion out to 1990 with no apparent trend. Its average over the 1981–1990 period would be $9 billion as compared to the $15 billion average observed during the 1971–1980 period.

Farm asset values also decline substantially in this scenario. By 1990, they are projected to be 82 percent of their 1983 value in nominal terms and 75 percent in constant dollar terms. All of this decline takes place in physical assets, with the principal loss

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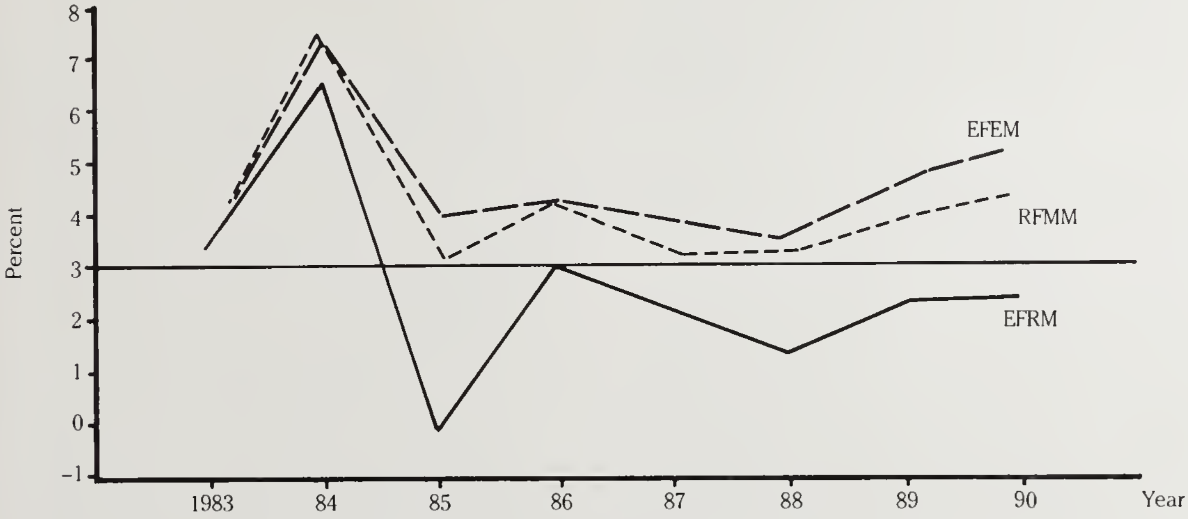
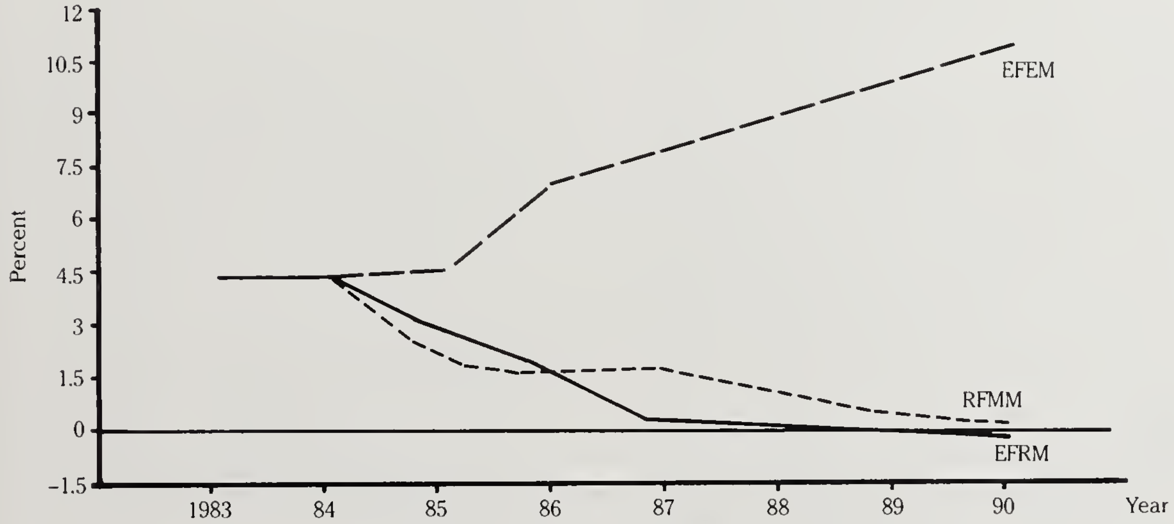
[2] Graphs are used to present key results in this paper. A full set of tables which include projections of macroeconomic conditions, the balance sheet of the farming sector, the farm income statement and the sector's cash sources, and uses of funds statement are presented by Hughes and Penson.

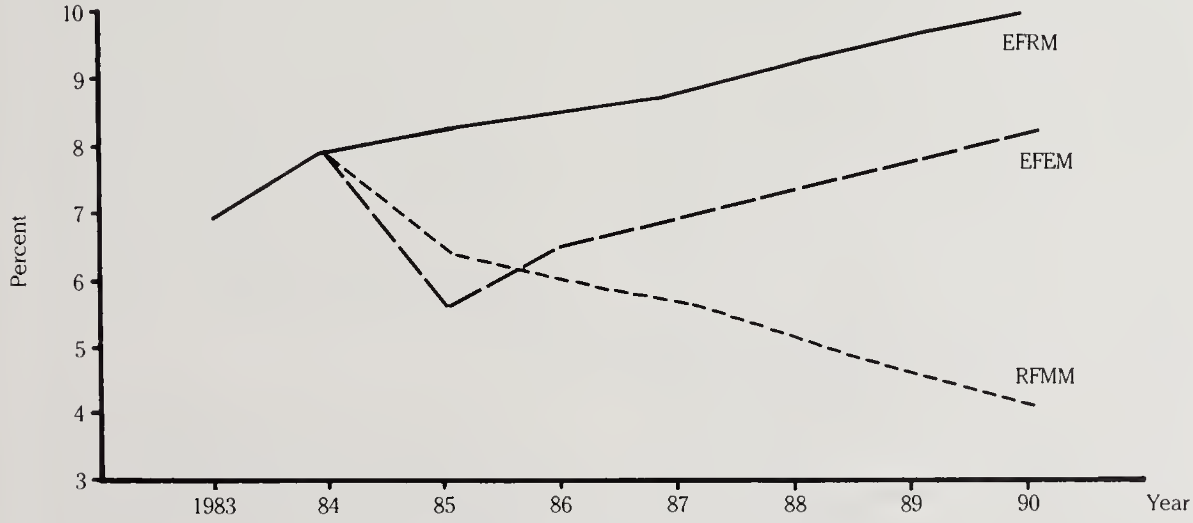
Figure 1. Projected Trends in General Economy Under Alternative Macroeconomic Policies



Panel a: Percent change in real GNP 1983–1990

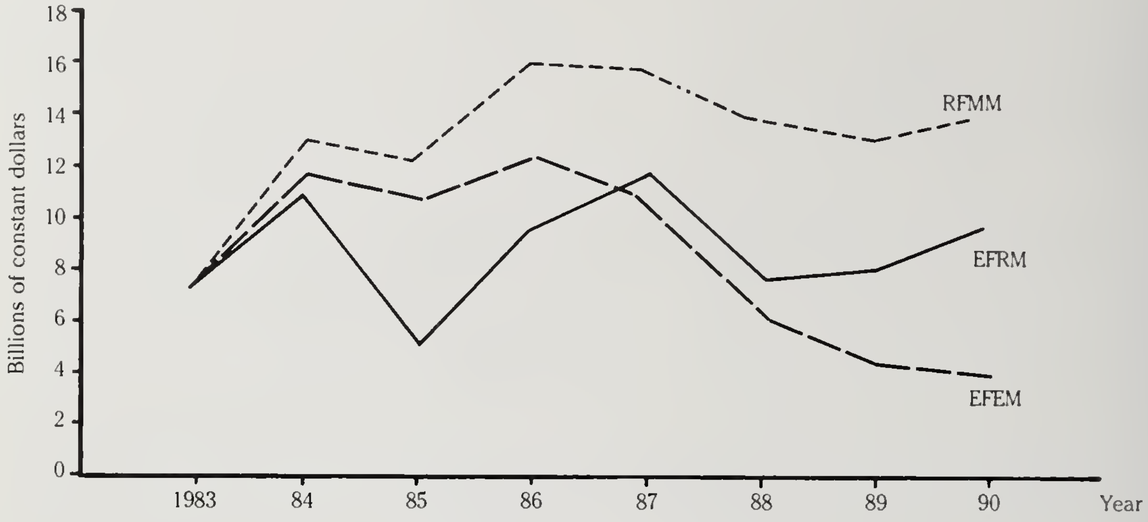


Panel b: Percent change in GNP deflator: 1983–1990

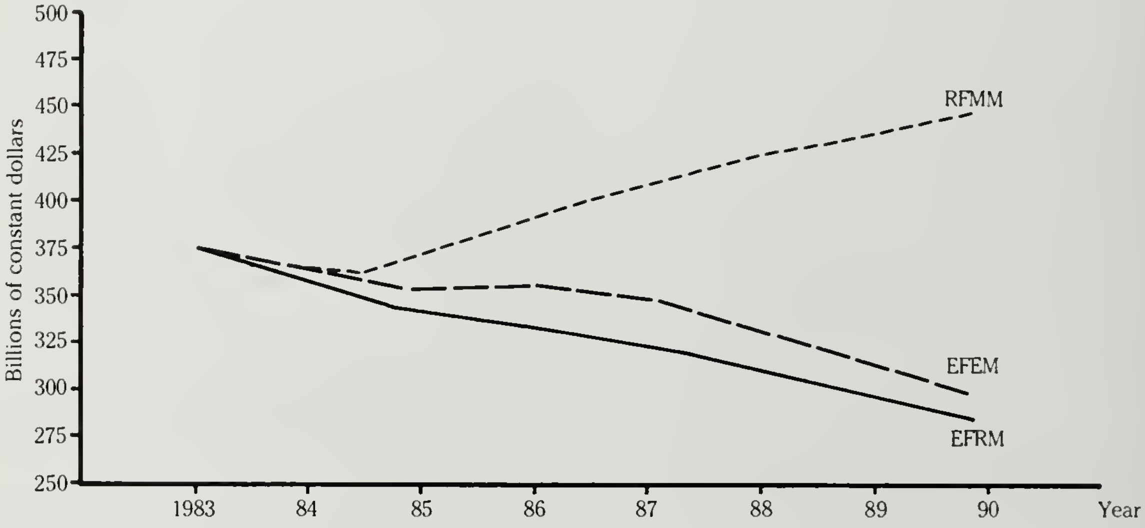


Panel c: Ex post real prime interest rate 1983–1990

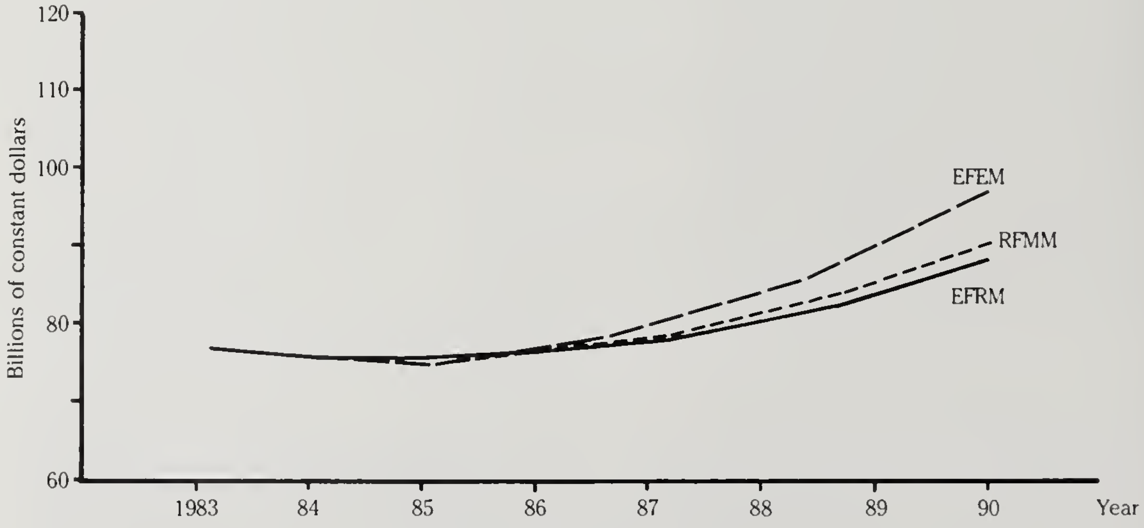
Figure 2. Projected Trends in Farm Sector Under Alternative Macroeconomic Policies



Panel a: Real net farm income 1983–1990



Panel b: Real farm asset values 1983–1990



Panel c: Real total farm debt 1983–1990

coming in farm real estate values. Financial assets grow under this scenario, reflecting the incentives for farmers to divert their available funds into nonfarm assets.

Debt is projected to grow, but at a much slower rate then experienced in the 1970s.[3] The average growth in nominal farm debt during the 1980s under this scenario would be four percent. This compares with a growth in nominal farm debt of 13 percent during the 1970s. Almost all of the projected growth in debt would be collaterized by real estate. While real estate values are declining in this scenario, it still provides the safest collateral for farm loans. Moreover, net farm incomes are projected to be so low that farmers will have difficulties repaying short-term loans and may need to refinance their debts over longer repayment periods. Such refinancing would almost certainly shift debt to the real estate category.

The net result of declining assets and increasing debt is a substantial decline in sector wealth and increasing leverage. Proprietors' equities would decline 29 percent in nominal terms and 35 percent in constant dollars. The debt-to-asset ratio for the sector is projected to grow from 21 percent in 1983 to 32 percent in 1990. Certainly the sector would have far fewer farmers without debt if these projections are realized. In addition, farmers with low debt-to-asset ratios in 1983 would likely be more highly leveraged by 1990. And those farmers who currently have moderate to high leverage ratios will likely be out of business.

Examination of projected cash sources and uses of funds in the sector also reflects adjustments in agriculture imposed by the macroeconomic policies assumed in this scenario. Capital outlays by farmers and nonfarm landlords to maintain equipment and structures and to buy farm assets from discontinuing proprietors are projected to average 79 percent of net cash income between 1985 and 1990 as opposed to the 57 percent average observed over the 1971–1979 period. The principal reason for this shift is the decline in the net inflow of loan funds. The ratio of the net flow of loan funds to total capital flow is projected to decline from the annual average of 48 percent observed in the 1970s to an annual average of 16 percent during the 1985–1990 period.

Prospects for the sector are dim if the deficit remains high for the next six years and if there is another round of fighting inflation exclusively through monetary policy. Farm incomes will likely remain low, asset values will probably continue to decline, and debt financing might be constrained. Under these conditions, the sector would probably end the decade in very weak financial health, unable to show much resilience to change and perhaps less productive than it is currently.

EFEM: High Deficits and Faster Growth in Money

Annual government budget deficits in this scenario are also held at their 1984 level in real terms through 1990. A more expansionary monetary policy that allows the inflation rate to grow at about one percent per year is assumed. The effects of these policies on the economy in general and the farm sector in particular are as follows.

Events in the general economy. The impact of these policies would be reflected largely in real interest rates; these rates first decline in 1985 and then return to 1984 levels by 1990 (dashed line in panel c of figure 1). The surprise of having monetary authorities reverse their policies is projected to allow both nominal and real rates to decline in the short run. As this new policy stance becomes generally accepted and built into expectations, however, real rates will grow to clear financial markets still servicing huge government borrowing demands. Nominal rates will grow even faster, reflecting continuing increases in inflation.

Growth in real GNP (dashed line in panel a of figure 1) is higher than the annual rates of growth in the EFRM scenario for all years. Since this growth is also higher than the sustainable three percent increase in potential GNP, it is probably being borrowed from future periods. This means that a renewed fight against inflation will likely be needed sometime after 1990 to reduce GNP to its long-run growth path. Inflation (dashed line in panel b of figure 1) is held low through 1985 by policies already implemented during 1984. It is then projected to jump about 1.5 percentage points in 1986 and grow at a rate of one percentage point per year through 1990.

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[3] Debt may decline under these conditions through substantial write-offs of farm loans by lenders. The model does not capture this because such actions have not occurred in the 1956–1980 period that underlie its coefficients and because the discrete nature of such actions are not included in the model's continuous functional forms.

Implications for the farm sector. The projections of the impacts this set of macroeconomic policies will have upon the farm sector are less obvious, but perhaps more interesting than the EFRM scenario. Basically, the projections suggest that a faster growth in money helps the farm sector in the short-run (about three years), yet it is harmful to the sector over the long-run. Real net farm income (dashed line in figure 4) is projected to be higher than in the first scenario through 1986. This is principally due to higher domestic and foreign demands for food. The recession projected for the domestic economy in 1985 under the EFRM scenario is not expected with an easier monetary policy. The early reduction in U.S. real interest rates in the EFEM scenario will reduce the value of the dollar versus other currencies and stimulate the demand for agricultural exports. By 1990, however, growth in real interest rates will increase the value of the dollar, decrease export demand, and add to farmers' interest expenses. Moreover, the high rate of inflation in this scenario will generate rapid increases in farm production expenses. Long-run constraints on growth in demand and rapid increases in production expenses result in projections of real net farm incomes in the late 1980s which are substantially below those generated by either of the other two scenarios.

The decline in real farm asset values (dashed line in panel b in figure 2) with a faster growth in the money supply is slower in the first few years of the projections, but faster in later years because farm profitability is lower. One almost comforting point to note here is that projections of nominal farm asset values increase throughout the 1980s, because the rate of inflation exceeds the real price declines for land.

Growth in real farm debt is highest for this scenario, although still slower than the growth rates observed in the 1970s (dashed line in panel c of figure 2). The average annual compound growth rate in real debt from 1984 through 1990 in this scenario is four percent, which is much lower than the six percent growth rate seen in the 1970s. The reasons for the faster growth in debt are related to farm debt repayment problems caused by the declining incomes after 1986, lower real interest rates, and slower declines in asset values than seen in the EFRM scenario. This generates more demand for debt financing and provides more collateral to allow the demand to be realized.

Examination of the cash flows and financial ratios for the EFEM scenario confirm the stories told by the sector income statement and the balance sheet. After two or three years of improved financial conditions, impacts of more rapid inflation on the sector become evident. Capital purchases start to exceed net cash income from farming in 1989. Loan funds are more highly relied upon in the late 1980s than in the first scenario. While loan funds are projected to account for an average of only 27 percent of purchased capital in 1984 through 1986, the average increases to 77 percent in 1987 through 1990. The ratio of debt outstanding to total cash income grows from 3.8 in 1983 to 6.6 in 1990. Finally, the debt-to-asset ratio for the sector increases from 21 percent in 1983 to 33 percent in 1990. Such an increase indicates that many of the same adjustments expected from the EFRM scenario would be required, even with a less restrictive monetary policy. The principal difference between the first two scenarios is that, when problems are postponed by inflating the economy, adjustments are made in a shorter period of time.

Monetizing the deficit is, therefore, probably not the solution to farm sector problems. It leaves the farm sector at the end of the decade with lower incomes, slightly higher real asset values, and more debt than if monetary policy were restrictive.

RFMM: Lower Deficits and Moderate Growth in Money

The annual government budget deficit is assumed in this scenario to be declining by about 15 percent per year in real terms through 1990 due to an assumed slowing in the growth of government expenditures.

Monetary policy is to allow a moderate growth in money, which would lead to an inflation rate of less than one percent by the end of the decade. Again, it is hard to imagine economic policymakers being able to generate the smooth transition to a noninflationary economy suggested by the model. The implications for the farm sector with such a transition, however, are enlightening.

Events in the general economy. The projected growth in real GNP in the RFMM scenario lies between the projections for the other two scenarios. It is higher than the EFRM scenario because monetary policy is less restrictive. And it is lower than the EFEM scenario because monetary policy is more restrictive and fiscal policy is less stimulative.

Inflation (dotted line in panel b of figure 1) is the driving force in developing monetary policy for this scenario. This figure shows that it rather smoothly declines to almost zero in 1990. It drops more quickly in 1985 and 1986 than in the EFRM scenario due to the reduction in fiscal stimulus to the economy. Its rate of descent is less after 1986, reflecting a less restrictive monetary policy.

Real interest rates (dotted line in panel c of figure 1) underscore the significant reductions that could be gained if monetary and fiscal policies were to work together toward a common goal. Continued reduction in government borrowing reduces the total demand for loanable funds. On the other side of the market, a less restrictive growth in the money supply adds to the supply of loanable funds in the economy. The net result is declining real interest rates throughout the period. Moreover, declines in inflation help nominal interest rates to fall even more.

Implications for the farm sector. Once again, the implications for the farm sector are clear. This scenario would lead to higher incomes, rising assets values, and moderate growth in the use of debt financing. Real net farm incomes (dotted line in panel a of figure 2) rise rapidly and then fluctuate at higher levels. While projections of real incomes do not reach the $26 billion level of 1973, they substantially exceed the levels achieved in the early 1980s. The projected average real net farm income over 1985–1990 period is $14 billion compared to only $9 billion for 1980–1983 period. The reasons for this increase can again be attributed to the interest and inflation rates. Lower interest rates decrease the value of the dollar and expand export demands. They also help increase domestic demand by holding economic growth high and inventory carrying costs low. At the same time, lower rates of inflation keep production expenses from growing rapidly. The net result is a higher level of profitability for the sector.

When higher profitability is combined with lower interest rates, farm asset values start to increase again (dotted line in panel b of figure 2). The average annual compound growth rate for real farm asset values from 1985 through 1990 for this scenario is four percent. While this is less than the six percent real growth in the 1970s, real interest rates in the scenario continue higher than those in the last decade. Most of the gain in the value of assets is in farm real estate, although machinery and equipment also show steady gains.

Almost surprisingly, outstanding farm debt (dotted line in panel c of figure 2) expressed in constant dollars shows only a moderate growth under the RFMM scenario; a 3.5 percent annual average compound growth rate over the 1985–1990 period. The reasons for this slow growth in farm debt are that more internal funds are available due to higher levels of profitability and real interest rates, while declining, continue to be high by historic standards.

Examination of cash flows and financial ratios shows the farm sector would be in much better financial condition by the end of the decade under the RFMM scenario. Purchases of capital account for only about two-thirds of net cash income. And, the ratio of debt outstanding to total cash income declines from 3.8 in 1983 to 3.0 by 1990. The sector's debt-to-asset ratio also declines from 21 percent in 1983 to 20 percent in 1990. Under the macroeconomic policies assumed in this scenario, adjustments currently underway in the sector would likely be stopped or reversed. Instead of going out of business, highly leveraged farmers and ranchers would likely do very well. Farmers who prefer to be without debt could probably avoid borrowing. And, farmers with moderate debt-to-asset ratios would not be forced into more highly leveraged situations.

Contrary to the results under the other two scenarios, reductions in government deficits and moderate restraint in monetary policy could lead the farm sector to an improved financial condition by the end of the decade. Steady economic growth, lower inflation and lower interest rates would probably result in higher net farm incomes and asset values, and moderate growth in farm debt. This suggests that the sector could be more resilient to weather and other shocks and likely be more productive than it is today.

Summary and Concluding Comments

Current financial conditions in the farm sector indicate that some farmers are having substantial difficulties in adjusting to general economic conditions. Large government deficits and a monetary poicy that has reduced the inflation.rate by more than one-half in three years have changed the economic environment for farmers. While the general economy has exhibited a vigorous recovery over the last year, agriculture has not benefited. The current blend of macroeconomic policies tilts returns in the economy away from production activities sensitive to interest and exchange rates. Since farm production is one of the few sectors sensitive to both rates, it has continued to suffer even though profitability has returned to most other sectors of the economy.

What the future is likely to bring for the sector depends on decisions made about future blends of monetary and fiscal policies. Due to political and other uncertainties, point forecasts of what will actually occur were avoided. Three sets of assumptions about future macroeconomic policies were used to represent the range of possible outcomes for the farm sector through the end of the decade. The first two scenarios assumed a continuation of large government deficits. The EFRM scenario also assumed restrictions on growth in the money supply needed to quickly eliminate inflation. The EFEM scenario, on the other hand, assumed a rapid growth in the money supply that led to higher inflation rates. The RFMM scenario was designed to look at what reducing government deficits and moderating the growth of the money supply imply for future financial conditions in the farm sector.

Both the EFRM and EFEM scenarios, which assumed the existence of large deficits, showed a farm sector with substantial financial problems at the end of the decade. Both scenarios suggested high real interest rates, low farm incomes, declining farm asset values, and some growth in farm sector leverage. Neither indicated significant declines in the production of food and fiber, but substantial dislocations in ownership patterns would likely result. If problems of the magnitude projected in these scenarios lead to ownership patterns that are significantly different from past patterns and bring in outside equity financing, risks of insolvency may eventually be reduced. These lower risks will, however, be accomplished by an ever-widening split between ownership and mangement in the sector.

A reduction of budget deficits and a moderate monetary policy assumed in the RFMM scenario generated significantly different results for the farm sector. Under this scenario, higher farm incomes, increasing asset values, and moderate growth in farm debt would occur. Such outcomes would likely leave the sector more productive and more capable of dealing with external shocks.

Current farm credit policy proposals that restructure debt or postpone payments may serve a useful purpose in buying some time so that more fundamental problems can be addressed. They are not, however, sufficient to solve farm sector difficulties by themselves if current macroeconmic policies are continued. In fact, the possibility exists that they may do more harm than good. Postponing farm problems by interfering in farm credit markets may compress eventual adjustments into a shorter time period and lead to greater dislocations and human suffering. Only a more restrictive fiscal policy and less restrictive monetary policy appear to permanently alleviate the financial stress facing many farmers.

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Debt-to-Asset Ratios of Ohio Farmers A Polytomous Multivariate Logistic Regression of Associated Factors

Allan E. Lines and Carl R. Zulauf

Abstract

This paper describes an analysis of the relationship between debt-to-asset ratios and selected socioeconomic characteristics obtained from a sample of Ohio farm operators. The analysis was based on polytomous multivariate logit regression. A statistically significant relationship was found between debt-to-asset ratio and operator age, farm size, and percent of land farmed that was owned. No statistically significant relationship was found between debt-to-asset ratio and major source of farm income and off-farm income as a percent of family income.

Key words: debt-to-asset ratio, financial stress, farmers, farm sales, farmer age, owned land.

Since 1979, average debt-to-asset ratio on U.S. farms has increased from 17 percent (a level at which it had essentially remained for the preceeding 15 years) to an estimated 22 percent in 1984 (USDA, December 1984). The latter is the highest ratio since before 1940. Also since 1979, U.S. farm debt has increased by 53 percent, assets have increased by only 18 percent, and net cash income has declined by $16.5 billion (USDA, December 1984). Farmers, thus, need to service considerably more debt with substantially fewer dollars. The result has been increasing numbers of farm bankruptcies, loan liquidations, and delinquent loans; in short, financial stress (USDA, 1985).

Several financial aid programs have been proposed to alleviate this stress (Swoboda; Sesker; Bullock; Harl; Boehlje; Paarlberg). These programs include the Reagan Administration's initiative, which has been implemented by USDA. Debate over this and other programs has been intense. A recent attempt by Congress to increase substantially the amount of federal aid available to farm operators was vetoed by President Reagan (Weintraub).

One reason for the continued debate is the lack of information concerning the magnitude, incidence, and extent of the financial stress problem. Recent studies have supplied some of this information. USDA has estimated that, on January 1, 1984, 363,000 farms (16.6 percent) were under some form of financial stress. Family-size commercial farmers ($50,000-$500,000 in sales) in financial stress numbered 178,000, 46 percent of the total. For south Georgia operators, Musser, White, and Smith found that as

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percent of land operated that was owned increased, debt-to-asset ratio decreased. Barlett, in a study of Dodge County, Georgia, farmers, found this same relationship as well as a positive relationship betweeen debt-to-asset ratio and farm size and off-farm income. Jolly, in a study of Iowa farm operators, found that younger operators and operators of larger farms reported higher debt-to-asset ratio. Similar results were reported by both the Missouri and North Dakota Crop Reporting Services. In addition, USDA reported substantial variation in debt-to-asset ratios by farm types, with poultry and egg farmers being the most highly leveraged (1985).

While these studies have increased the understanding of the farm financial stress problem, each is essentially based on cross-tabulation of data by selected characteristics. Thus, their conclusions on the relationship between debt-to-asset ratios and farm characteristics have not been subjected to multivariate analysis. Ohio farm operators were randomly surveyed about their debt-to-asset ratios and selected other farm characteristics. Using the survey data, this study seeks to provide information about the farm financial stress problem by determining what, if any, of several common farm characteristics are statistically associated with farm operator's debt-to-asset ratio.

According to USDA's *1983 State Income and Balance Sheet Statistics*, Ohio farm operators had an estimated debt-to-asset ratio of 18.9 percent on January 1, 1984. This ratio was smaller than the corresponding 21.6 percent average for the U.S., 26.1 percent average for Iowa, and 30.1 percent average for Nebraska. Thus, as a group, Ohio farmers are probably less stressed by debt than U.S. farmers in general and central plains state farmers in particular. Despite the lower debt stress, this study should provide insights into the extent and nature of the national farm financial stress problem.

The paper is organized as follows: (a) a conceptual discussion of debt-to-asset ratio as an indicator of farm financial stress; (b) a review of the Ohio farm operator survey and sample data; (c) a brief rationale for selecting logit regression as the analytical technique; (d) a description of the model estimated; (e) a discussion of the empirical results; and (f) conclusions and implications.

Debt-to-Asset Ratios: A Conceptual Discussion

Although only one of several financial stress indicators, debt-to-asset ratio is frequently used to provide insight about farm financial stress. The validity of this ratio as a stress indicator arises from the fact that it measures the relative claim which debt has on the earnings generated by the farm's assets. The greater the debt, the greater the share of earnings (income minus cost of production excluding debt payment) generated by the assets which must be used to service debt. Hence, the greater the likelihood that earnings cannot cover production expenses, family living expenses, and debt payments. The result is cash flow problems and financial stress. Gabriel and Baker develop a conceptual framework that reveals the effects of leverage-induced changes in the variability of net cash flows resulting from fixed financial obligations associated with debt financing. Financial stress also depends on the cost of debt (interest rate) and the rate of earnings generated by the assets. The latter in particular has been shown to vary significantly with farm characteristics, most notably farm size. Large farms have higher rates of return on their assets (Melichar). Shepard and Collins, in their study of farm bankruptcies from 1910 to 1978, found a strong relationship between failure rates and leverage during the pre-World War II period; a period not unlike that of the 1980s when farm debt-to-asset ratios increased dramatically. Richardson and Condra demonstrate the critical importance of debt-to-asset ratio in determining the survivability of a farm business in the El Paso valley. In conclusion, although the context in which debt-to-asset ratio is being used should always be examined, it is a fairly reliable indicator of the potential for debt stress.

Survey

The data were generated by a random sample of 2,000 Ohio farm operators during March 1984. The sample was drawn from the universe of all Ohio farm operators, as identified by the Ohio Crop Reporting Service. One mailing resulted in 423 usable responses, a 21 percent response. As part of a larger questionnaire, surveyed operators were asked to report their debt-to-asset ratio, age, number of acres farmed, percent of acres farmed which were owned, average annual gross farm sales in recent years, most important source of farm income in 1983, and percent of total family income that came from off-farm employment and investments in 1983. Except for percent of acres farmed which were owned, categorical data were collected. It was felt that, given the nature of the data being collected, asking for specific continuous data would result in a lower response rate.

Respondents mirrored the characteristics of Ohio farmers as reported in the *1982 Agricultural Census*, with the exception that operators of large farms were over-represented. Average number of acres farmed by the respondents was 372, compared with 175 reported in the *Census*. Seventy-six percent of the respondents farmed less than 500 acres. Nearly half reported $40,000 or less in gross farm sales while almost three-fourths reported $100,000 or less in gross farm sales. Respondents were a mixture of crop, dairy, livestock, and other types of farmers. The distribution of respondents to debt-to-asset categories was: no debt, 42 percent; one to 25 percent debt-to-asset, 29 percent; 26 to 50 percent debt-to-asset, 16 percent; and 51 percent or greater debt-to-asset, 13 percent. On average, the respondents owned 64 percent of the land they operated. Forty-three percent of the respondents reported off-farm income was less than 25 percent of family income while 37 percent reported it was 50 percent or more.

Logit Regression

The object of this study is to determine what common farm characteristics are statistically associated with a farm operator's debt-to-asset ratio. Since debt-to-asset ratio was collected as an ordinal level categorical variable, the standard least-squares regression model (also called the linear probability model in this case) will have an error term which is heteroscedastic (Pendyck and Rubinfeld, p. 276; Johnston, p. 424). Weighted least-squares can be used to address this problem. However, not only is weighted least-squares sensitive to errors of specification, there is also no guarantee that the predicted values for the dependent variable will lie within the range of the categorical values (Pendyck and Rubinfeld, p. 276; Johnston, p. 425). A constraint can be placed on the estimated value of the dependent variable, but there is no guarantee that the estimated parameters will be unbiased (Pendyck and Rubinfeld, p. 278). Thus, ordinary least-squares is not preferred on theoretical grounds. Furthermore, it has been shown to yield lower quality empirical results than alternative analytical techniques (for example, Debertin, Pagoulatos, and Smith; McKelvey and Zavoina).

Alternative analytical tools for models with qualitative dependent variables include linear discriminant analysis, probit, and logit. Maximum likelihood logistic regression, which is based on the cumulative logistic probability function, is preferred over discriminant analysis whenever one of the independent variables is qualitative (Halperin, Blackwelder, and Verter; Press and Wilson). This preference is in part based on the fact that linear discriminant analysis is strictly applicable only when the underlying variables are jointly normal with equal covariance matrices. In contrast, the logistic model results from a wide variety of underlying assumptions about the explanatory variables, including the case when some or all of the independent variables are dichotomous zero-one variables (Anderson, Halperin, et. al.) Furthermore, the discriminant function can yield a misleading result regarding the significance of a coefficient when the normality condition is violated (Press and Wilson, p. 701; and Halperin, et. al., p. 130).

Both the logit model and probit model, which are based on the cumulative normal probability function, have been used in the agricultural economics literature (for recent examples, see Chambers and Foster, probit; Garcia, et. al., logit; and Capps and Kramer, logit and probit). The logistic and probit formulations are quite similar, with the major difference being that the logistic has slightly more skewness toward the tails. The choice of technique (probit or logit) is somewhat arbitrary, as illustrated by the recent empirical analysis by Capp and Kramer. " . . . neither specification was judged superior. Hence, . . . the differences in empirical performance between the respective models were indeed minimal" (Capp and Kramer, p. 58). Logit regression was selected for this analysis of debt-to-asset ratio.

Model Estimated

The common farm characteristics hypothesized to be statistically significant discriminators of farm operators by debt-to-asset categories were gross farm sales, operator age, type of farm as defined by major source of farm income, percent of total family income that came from off-farm income, and percent of land operated that was owned. The specific logistic regression package chosen to conduct the analysis was LOGIST (Harrell; Walker and Duncan). The multinomial logit model estimated can be stated as follows:

$$\log (P_2/P_1) = \alpha_{21} + \sum_{j=1}^{n} \beta_{2_j} X_{ji} \tag{1.1}$$

$$\log (P_3/P_1) = \alpha_{31} + \sum_{j=1}^{n} \beta_{3_j} X_{ji} \tag{1.2}$$

$$\log (P_4/P_1) = \alpha_{41} + \sum_{j=1}^{n} \beta_{4_j} X_{ji} \tag{1.3}$$

$$\log (P_3/P_2) = \alpha_{32} + \sum_{j=1}^{n} \beta_{3_{j+1}} X_{ji} \tag{1.4}$$

$$\log (P_4/P_2) = \alpha_{42} + \sum_{j=1}^{n} \beta_{4_{j+1}} X_{ji} \tag{1.5}$$

$$\log (P_4/P_3) = \alpha_{43} + \sum_{j=1}^{n} \beta_{4_{j+2}} X_{ji} \tag{1.6}$$

where P_i is the relative probability of having a specified percent of debt, with the i categories given as:

1 = no debt,
2 = one to 25 percent debt,
3 = 26 to 50 percent debt, and
4 = 51 to 100 percent debt.

The independent variable vector X_{ji} (i*th* producer) is comprised of the following variables:

X_{ji} = gross sales category of operator i (excluded category is $40,000 or less)

for j = 1 (1 if gross sales of $40,001 to $99,999, 0 if not)

for j = 2 (1 if gross sales of $100,000 to $199,999, 0 if not)

for j = 3 (1 if gross sales of $200,000 or more, 0 if not)

X_{ji} = age category of operator i (excluded category is 65 or more years)

for j = 4 (1 if operator less than 35-years old, 0 if not)

for j = 5 (1 if operator 35 to 49 years old, 0 if not)

for j = 6 (1 if operator 50 to 64 years old, 0 if not)

X_{ji} = type of farm for operator i (excluded category is grain farm)

for j = 7 (1 if a livestock farm, 0 if not)

for j = 8 (1 if a dairy farm, 0 if not)

for j = 9 (1 if a 50/50 grain-livestock farm, 0 if not)

for j = 10 (1 if other type of farm, 0 if not)

X_{ji} = percent of total family living income coming from off-farm sources for operator i (excluded category is zero to 24 percent)

for j = 11 (1 if off-farm income was 25 to 49 percent of total family income, 0 if not)

for j = 12 (1 if off-farm income was 50 to 74 percent of total family income, 0 if not)

for j = 13 (1 if off-farm income was 75 to 100 percent of total family income, 0 if not)

X_{ji} = percent of land operated that is owned by operator i

Parameter estimates for equations 1.4 to 1.6 can be derived from the estimates for equations 1.1 to 1.3. For example,

$$\alpha_{32} = \alpha_{31} - \alpha_{21} \text{ and } \beta_{32} = \beta_{31} - \beta_{21}, \text{ etc.}$$

In this paper, we are only interested in estimating the parameter vectors for equations 1.1 to 1.3, the relative probabilities of carrying specific percentages of debt relative to no debt. The relative probability of any debt to no debt can be easily derived from these first three equations. Only the parameter estimates for equations 1.1 to 1.3 are presented. The reader can easily calculate those for equations 1.4 to 1.6.

The parameter estimates are obtained by solving the nonlinear maximum likelihood normal equations. While this is computationally more expensive than applying the linear probability least squares approach, the parameter estimates have more desirable properties. They are consistent, asymptotically efficient, and asymptotically normal. Individual parameters can be tested similar to the "t" test in regression, while statistical significance of the overall equation can be tested with the –2 log likelihood ratio.

The estimated parameters for gross farm sales and off-farm income were expected to be positive. The larger gross farm sales or off-farm income is, the greater the debt that can be accumulated, and, with a given asset base, the greater the debt-to-asset ratio becomes. Operator age was expected to be negatively related with debt-to-asset ratio. As a farmer approaches retirement, he is less likely to acquire new debt and more likely to retire existing debt. Thus, the debt-to-asset declines, a relationship consistent with Jolly's finding. Farmers who classify their main source of farm income as grains were expected to have higher debt-to-asset ratios. This expectation was based on the fact that grain farming is land intensive. Not only did land prices increase significantly during the 1970s but the need to maintain an adequate income pushed the grain farmer to acquire land. Lastly, the greater the share of land operated that was owned, the lower the debt-to-asset ratio was expected to be. Generally, the smaller the percent of land farmed that is owned, the smaller the amount of capital owned since land is the major capital input in farming. Consequently, a given level of operating debt translates into a higher debt-to-asset ratio for smaller percentage of land operated that is owned.

Results

The estimated coefficients in table 1 must be interpreted with care. The left-hand sides of the equations in the logistic model are logarithms of the odds of being classified in a category, not the probability of being in the category. However, since a logarithm is a monotonic transformation, the logarithms of the odds reveals some characteristics of the underlying probability (Pendyck and Rubinfeld).

Table 1. Maximum Likelihood Estimates of Log Probabilities of Factors Associated with Debt-to-Asset Ratios of Farm Operators, Ohio, March 1984.

Variable[a]	Estimated Coefficients	Standard Error
Alpha		
21	0.83	.53
31	–2.57*	.54
41	–3.85*	.55
Gross Sales Variables		
$40,001 to $99,999	.82*	.31
$100,000 to $199,999	1.11*	.38
$200,000 or more	2.03*	.47
Age Variables		
less than 35	2.30*	.53
35 to 49	2.33*	.46
50 to 64	1.46*	.44
Type of Farm Variables		
Livestock	–.21	.33
Dairy	.22	.33
50/50 Livestock-Grain	.27	.36
Other	–.06	.39
Off-Farm Income		
25% to 49%	.06	.36
50% to 74%	.05	.35
75% or more	.10	.34
Percent of Land Operated That Was Owned	–.01*	.003

Model R = .35[b]
Model Chi-Square Statistic = 129, 14 d.f., p = 0.0

Source: Computations on original data.

[a]For a discussion of the variables, see the text.

[b]Measure of fit, ranging between 0 and 1.

*Significant at the one percent level of confidence.

For the dummy variables, the coefficients are the change in the logarithms of the odds of being classified in a higher debt-to-asset category because the operator has a given attribute instead of the attribute used to create the dummy variable. For example, having gross sales between $40,001 and $99,999 instead of less than $40,001, results in a higher logarithm of the odds, therefore probability, of being in a higher debt-to-asset ratio category.

Each of the gross sales and age dummy variables were significantly different from zero at the one percent level of significance. The coefficient also had the hypothesized sign. The test for significance was based on the Wald statistic, a maximum likelihood chi-square statistic. It is calculated by dividing the estimated parameter by its standard error and squaring the result (Harrell, p. 182.)

As gross sales increased, the coefficient on its associated dummy variable was significantly more positive at the one percent level of significance than the coefficient on the next smaller gross sales category. This finding supports the cross tab analyses which have found that larger farms have higher debt-to-asset ratios than smaller farms (USDA, 1979 and December 1984; Melichar; Barlett; Jolly).

Turning to the age variables, the findings support the commonly held opinion that younger farm operators have higher debt-to-asset ratios (age was dummied on the oldest group, 65 or more). Again, a similar relationship has been reported by others, but their findings have been based on cross-tab analyses (USDA, 1979; Jolly). Note that the coefficient for the two youngest age group dummy variables are almost identical. Thus, compared with farm operators 65 or older, operators less than 35 are not more likely to be in a higher debt-to-asset category than are operators between 35 and 49-years old. This finding does not support the perception that young operators are more likely to have higher debt-to-asset ratios than their middle age counterparts. The data does, however, indicate that operators less than 50-years old are more likely to fall in the next higher debt-to-asset category than those in the 50 to 64 age group.

In contrast to the coefficients for gross farm sales and age variables, the coefficients for percent of total income earned off the farm and type of farm variables were not statistically different from zero. Thus, grain farmers and farmers who earn most of their family's income off the farm did not have higher probabilities of having higher debt-to-asset ratios. These findings fail to substantiate Barlett's or Gladwin and Zabawa's findings that part-time operators (i.e., higher percent of family income from off-farm income), on average, carry lower debt-to-asset ratios than full-time farmers or USDA's finding that debt-to-asset ratios vary significantly by farm type. Again, their conclusions were based on cross-tab analysis and thus not subject to multivariate analysis.

The percent of land owned coefficient is significantly different than zero at the one percent level of significance. For a one percent increase in the percent of land farmed that was owned, the logarithm of the odds that an operator will be in the next higher debt-to-asset ratio category decreases by .01. This finding is consistent with Barlett's finding that tenants were more highly leveraged than either full or partial owners.

Lastly, the estimated logistic multiple regression model had a likelihood ratio chi-square of 129 which was significantly different from zero at the one percent level of significance. The model explained 35 percent of the log likelihood variation. This value is analogous to the squared multiple correlation coefficient in the standard regression setting. While the value is low, it is not unreasonably low for cross-sectional categorical data. Also, the model correctly classified 76 percent of the observations in their observed categories.

Summary and Conclusions

This analysis accomplished three things: it provided empirical support for utilizing polytomous multivariate logit regression as an analytical tool for problems of the type investigated; it identified three independent variables that were statistically significant discriminators of Ohio farm operators' debt-to-asset ratios (gross farm sales, operator's age, and percent of land farmed that was owned); and it identified two independent variables that were not statistically significant discriminators of Ohio farm operators' debt-to-asset ratios (major source of farm income and percent of family income coming from off-farm sources).

These findings suggest that in Ohio, financial stress, as indicated by debt-to-asset ratio, is widespread across farm types and degree of farm family dependence of off-farm income. Also, middle aged Ohio farm operators appear to be experiencing as much financial stress as their younger counterparts. Therefore, relief targeted at full-time Ohio farmers or grain farmers (or some other type) or young, recent entrant farmers may address only part of the problem. In contrast, a broad spectrum approach is suggested by this analysis which probably means that the cost of a relief package will be high and involve significant slippage in that farmers who do not need help will likely qualify for the aid.

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Interest Rate Deregulation and Agricultural Banking: A Risk Programming Analysis

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Abstract

The impact of deposit interest rate deregulation on small agricultural banks is analyzed using a quadratic programming model that incorporates both risk and market imperfection. The model was used to generate risk efficient bank portfolios before, during, and after deregulation. Parameter variations were used to analyze portfolio adjustments resulting from improved matching of liabilities with nonloan assets, adoption of floating loan rates, and increased interest rates on loans. To cope with the riskier environment, agricultural banks must either accept greater portfolio risks, adopt more conservative portfolios, or more vigorously manage interest rate risks.

Key words: agricultural banking, interest rate deregulation, risk analysis, quadratic programming

The current era of regulatory change in U.S. financial markets is strongly influencing the cost and availability of loan funds for agricultural borrowers through its impacts on smaller rural banks. Interest rates are higher and more volatile than in the past, and have contributed to financial stress conditions for many farms and banks alike. Developing managerial strategies to cope with these conditions is an important task.

The major regulatory issues in financial markets have involved: (a) price controls for loans and deposits; (b) reserve requirements; (c) the structure and geographic scope of banking; and (d) the types of products and services that depository institutions may offer. In the early 1980s most of the emphasis was on the removal of interest rate ceilings on deposits, traditionally called Regulation Q (Winningham and Hagan). Legislation authorizing these changes is found in the Depository Institutions Deregulation and Monetary Control Act of 1980 and the Depository Institutions Act of 1982 (Federal Reserve Bank of Chicago, 1981, 1983). Changes in structural and product regulations are under consideration for the future.

Price deregulation was intended to improve the competitive position of banks in the savings market, to alleviate disintermediation pressures, and to offer more equitable investment opportunities to small savers. These changes were expected to impact heavily on smaller banks that had experienced greater funding problems and less flexible balance sheet management than larger banks (Barry, 1984). Although smaller banks have improved their access to

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loanable funds, they have also experienced higher, more variable costs of funds that add to banking risks and encourage more comprehensive management of rate-sensitive assets and liabilities.

In this article, portfolio theory under risk and imperfect loan markets is used to evaluate the impacts of interest rate deregulation on agricultural banks. A risk programming model of a small rural bank is developed to reflect the financial market environment before, during, and after price deregulation, and to evaluate the effects of various alternatives in asset/liability management and loan pricing on the risk, return, and composition of the bank's portfolio. Especially important are the stabilizing effects of management policies that increase the correlation between the bank's cost of funds and return on assets. The implications of the results are then considered in terms of actual bank performance, agricultural lending, and future regulatory changes.

Analytical Framework and Related Studies

The analytical framework relevant here is based on the joint effects of market structure and risk on the composition and scale of a bank's portfolio. Relatively few empirical studies have considered these joint effects, although developments in banking theory have brought them into the analytical framework (Baltensperger). As shown by Shull and Mason, a bank's asset choices generally are characterized by nearly perfect competition for securities, but imperfect competition in lending with the imperfections increasing in smaller banking markets that are farther removed from metropolitan areas (Barry, 1978). Under these conditions, the exogenous yield on securities combines with loan demand characteristics to influence a bank's pricing and portfolio policies; moreover, banks can consider segmenting their lending markets along competitive lines and pricing loans accordingly.

Under uncertainty, the investment (or default) risk from fluctuations in returns on bank assets and the interest rate risk from unanticipated changes in costs of funds likely have the greatest impacts on portfolio management (Barry, 1984). These risks combine with the above market characteristics to explain banks' diversification among assets and liabilities, reserves, leverage positions, and other risk responses. Several studies have used mean-variance analysis to evaluate risk-efficient bank portfolios in which risks are expressed by variances and covariances for returns on assets and costs of funds (Baltensperger; Robison and Barry; Tauer and Boehlje). However, these studies have assumed that all of the bank's assets and liabilities are acquired in perfectly elastic markets.

Klein and James combined the risk and market structure phenomena to show the theoretical implications for mean-variance efficient sets of holding assets characterized by downward sloping demand curves. In addition, Dixon and Barry extended the Klein-James framework to include the effects of estimation risk when the moments of the distribution of asset returns are unknown. They also considered the modeling implications of risk and market imperfections, and used a simplified banking situation to show that the portfolio effects of risk and market imperfections are not trivial.

Modeling Approach

The modeling approach followed here first specifies a small rural bank's financial environment and decision setting in a static mathematical programming model, generates a set of risk efficient bank portfolios, and finally analyzes various portfolio adjustments based on parameter variations for selected model solutions (Robison and Barry). These procedures are followed for three time points that represent the rural banking environment before, during, and after price deregulation. Time point one (TP1) represents the pre-deregulation conditions of the mid-1970s when the cost of funds and loan rates for rural banks in general were relatively stable and insulated from national market conditions. Time point two (TP2) represents an interim period prior to the 1980 act, characterized by higher, more volatile interest rates and by regulatory authorizations for banks to offer six-month money market certificates (MMC) and 30-month certificates of deposit (CD), both having rate ceilings indexed to the yields on U.S. government securities. Time point three (TP3) represents anticipated conditions for the postderegulation period.

For each time point, a set of risk-efficient portfolios is generated and then a base solution is selected for equilibrium analysis using a stipulated trade-off (λ) between risk and return in the model solution. Several values of λ are used since the risk-efficient sets shift significantly over the time points toward higher values of risk and returns. In general, the decision choices available in each base solution represent the methods of fixed-rate pricing and asset/liability management followed prior to deregulation. The equilibrium analysis introduces several managerial responses to a riskier, more competitive banking environment to evaluate their effects on the bank's portfolio. These responses include: (a) improved matching of liabilities with nonloan assets; (b) adoption of floating loan rates; and (c) increased interest rates on loans in conjunction with floating loan rates.[1]

General Model Specifications

The general characteristics of the bank model are summarized in table 1, under the assumptions that probability distributions are fully characterized by means and variances and that the imperfect loan assets have linear demand functions (Barnard). The objective function represents a trade-off between the bank's expected after-tax returns and variance of returns with risks represented by variances and covariances among the asset and liability activities.

The basic form of the objective function follows the specifications of the Rand quadratic program in which the objective is to minimize

$$\lambda CX + X'QX$$

where the Xs are the activity levels, C is a matrix of after-tax net income levels for the bank at various tax rates, Q is the variance-covariance matrix, and λ is interpreted as the slope coefficient for the risk efficient set. Minimization requires that the C values are entered with negative signs and, since λ is multiplied by the linear portion, then higher values of λ represent lower levels of risk aversion.

For each time point the acquisitions of assets and liabilities are constrained by limits on various sources of funds, capital requirements, and accounting specifications. The bank's decision variables include investments in agricultural and nonagricultural loans, purchasing taxable and nontaxable securities, acquiring funds from deposit and nondeposit sources, and paying taxes and dividends. The limit on allocable funds is the same at each time point; however, the specific data, activities, and constraints are tailored to each period's characteristics. The following discussion reviews the TP1 model in detail, and then indicates the primary changes for the TP2 and TP3 conditions.

Expected net yields for nonloan assets (federal funds, treasury securities, nontaxable securities) are the differences between mean values of weekly rates reported in the *Federal Reserve Bulletin* for the corresponding time period (1977 for TP1 and 1980 for TP2 and TP3) and operating expenses reported in the Federal Reserve's *Functional Cost Analysis* (FCA) for banks with less than $50 million in total deposits. Expected loan yields were found by partially solving an estimated loan demand equation (see the following section) and collecting the effects of the independent variables in the intercept term. Average default rates and operating expenses are then deducted from the intercept value to give a net loan yield, exclusive of the additional deposits fed back to the bank from its lending activities.[2]

The deposit feedback effect was specified as a reduction in the amount of allocable funds needed to acquire loans, thus increasing the effective loan yield. The deposit feedback rates for agricultural loans in TP1 and TP2 were specified as 28.8 percent, based on results of an earlier study by Barry (1978); a lower feedback of 25 percent for nonagricultural loans reflected greater sources for these loans in rural markets. These rates were reduced to 18.8 percent and 15 percent, respectively, in TP3 to reflect a greater emphasis on interest rates in loan pricing

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[1] Other parameter variations not reported here include the effects of changes in costs of funds, reserve requirements, deposit feedback, and elasticity of loan demand. These results are reported in Barnard.

[2] Data on operating expenses and default rates for agricultural loans came from the commercial and agricultural loan category of FCA reports for 1977 and 1980. Comparable data for nonagricultural loans were estimated as a weighted average of real estate and installment loan categories from the same source.

Table 1. Outline of Bank Model

	ASSETS				LIABILITIES		ACCOUNTING				
Constraint	**Agr. Loan**	**Non-Agr. Loan**	**Taxable Securities**	**Nontaxable Securities**	**Deposits**	**Borrow**	**Net Income**	**Taxes & Dividend**	**Ending Cash**	**Relation**	**Level**
	1	2	3	4	5	6	7	8	9		
Objective							C	$-C_t$		=	Max
Deposits					a					≤	B
Borrow						a				≤	B
Allocable Funds	a_f	a_f	a	a	$-a_r$	–a				=	0
Ending Cash	–a	–a	–a	–a	a	a		a	a	=	0
Capital Req.	a	a	a	a						≤	B
Income, Taxes, & Div.	–a	–a	–a	–a	a	a	a	a		=	0
Variance—Covariance											
Agr. Loan	σ_1^2										
Non-Agr. Loan	σ_{21}	σ_2^2									
Tax Securities	σ_{31}	σ_{32}	σ_3^2								
NonTax Securities	σ_{41}	σ_{42}	σ_{43}	σ_4^2							
Deposits	$-\sigma_{51}$	$-\sigma_{52}$	$-\sigma_{53}$	$-\sigma_{54}$	σ_5^2						
Borrow	$-\sigma_{61}$	$-\sigma_{62}$	$-\sigma_{63}$	$-\sigma_{64}$	σ_{65}	σ_6^2					

relative to the traditional deposit relationship (Barnard).

The costs of acquiring allocable funds are based on similar procedures. Expected costs for federal funds, large CDs, and Federal Reserve borrowing are the sum of mean values for their respective weekly interest rates, as reported in the *Federal Reserve Bulletin* for the corresponding time period, plus noninterest costs for these activities as reported in the FCA. Interest and noninterest costs (net of fees or service charges) for demand deposits, savings deposits, and time deposits came from the FCA reports.

The remaining activities allow for the transfer of net income to the objective function and for paying dividends and taxes. Since asset sales prior to maturity are not allowed, no provision occurs for capital gains taxes.

These decision variables are constrained by limits on various sources of funds and by obligations on legal reserves, capital requirements, taxation, and dividends. The model bank's initial capital structure was based on the average portfolio of 67 small rural banks in central Illinois for 1977 (Barnard). For TP1, total assets were limited to $14.81 million based on $1.01 million of equity capital and $13.80 million of liabilities comprised of demand deposits ($5 million), savings deposits ($3 million), time deposits ($5 million), large CDs ($.6 million), federal funds ($.1 million), and Federal Reserve borrowing ($.1 million).

Reserve requirements were modeled as a reduction in allocable funds for the various deposits. Capital adequacy is based on a capital-to-total asset ratio of .08, so that each dollar of asset acquisition depletes $.08 of equity. The initial equity of $1.01 million roughly equals the bank's investments in buildings and other fixed assets, neither of which are included in the model. Interest income, expenses, and other transactions occur at the end of the model period. Any excess income is transferred to an ending cash activity that measures net earnings after taxes and dividends.

The TP2 and TP3 models are similar to TP1, although the data and some other specifications are adapted to the changing financial market conditions. The major changes in TP2 are the use of 1980 data for costs, returns, and tax rates, increased equity capital of about 30 percent, and allowing acquisition of six-month MMCs and 30-month CDs.[3] The asset choices were the same as in TP1.

The TP3 model was intended to represent the financial environment after price deregulation is completed. When the model was formulated, little was known about deposits and other funding sources that would occur in a deregulated environment. However, it was anticipated that deposit classes would have narrower rate spreads between them with greater tailoring of maturities and other terms to the preferences of depositors. In this light, the banks' sources of funds included: federal funds ($.1 million), transactions accounts ($6.7 million—the sum of demand and savings accounts in TP2), four classes of time deposits ($6.8 million), Federal Reserve borrowing ($.1 million), and Federal Intermediate Credit Bank (FICB) borrowing ($.1 million).[4] The four time deposits represent deposit instruments of different maturities (90-day, 180-day, 12-month, 30-month) that coincide with the maturities of several U.S. Treasury bills and bonds.

Mean values of interest costs (except for FICB borrowing) are based on adjustments from the rate on 30-month CDs in TP2. The rate differentials for the other three time classes were based on average differences between mean annual rates for the respective U.S. Treasury securities over the 1975–1978 period. The rates for transaction accounts and fed funds were both .25 percent less than the 90-day rate. The FICB rate was the sum of the average rate for 180-day Treasury bills in 1980 plus a .4 percent spread for Farm Credit bonds plus a .2 percent FICB operating spread.

Asset activities in TP3 were the same as TP2, as were the expected yields for nonloan assets. However, the intercept values of the

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[3] Limits on the $13.8 million of allocable funds were as follows: federal funds, $.1 million; demand deposits, $4 million; savings deposits, $2.7 million; time deposits, $1.7 million; large CDs, $1.2 million; Federal Reserve borrowing, $.1 million; MMCs, $3.5 million; and 30-month CDs, $.5 million.

[4] FICB borrowing was included in response to the Farm Credit Act Amendments of 1980 that expanded the access of agricultural banks to this funding source.

Loan demand functions were increased to reflect the 1980 average rate on farm operating loans from agricultural banks in the Chicago Federal Reserve District. These ntercept values then were adjusted to net values based on 1980 loan expenses, loss rates, and the reduced deposit feedback. Other TP3 specifications were the same as TP2.

Risk and Imperfect Market Specifications

The objective function for the bank model is ormulated to yield a minimum variance-efficient set of bank portfolios for different evels of expected net income, where nvestment in loans is characterized by downward sloping demand curves. As Dixon and Barry have shown, under an assumption of linear uncertain demand, these conditions yield a portfolio model that is solved by quartic programming. If, however, the slope of the return function for loans is deterministic, as occurs here, then the model s solved by quadratic programming. Thus, he data required for the objective function nclude variances and covariances for rates of return on assets and costs of liabilities, and an estimated demand function for loans.

The variances and covariances among the iabilities and the perfectly elastic assets were calculated from the same data series used to estimate mean values for these activities in each TP model. The TP2 model had greater variability in rates and more sources of funds that were rate sensitive than n TP1. The same levels of variances were used in TP3 as in TP2, although all funding sources in TP3 were rate sensitive. Thus, TP3 had the greatest variability of the three models.

The covariances between assets and iabilities could not all be measured from a common data base due to differences in data availability for loan rates and to the estimation procedure for the loan demand unction. Thus, a judgmental approach was ollowed in initially specifying correlation coefficients of .5 between the return on nonloan assets and costs of liabilities and .2 between the returns on loans and costs of iabilities. These moderate levels of positive correlation reflect a general tendency for nterest rates to move together, although the oan rates are assumed to adjust more sluggishly. More rigorous management of assets and liabilities, as is evaluated below, would yield higher correlations. Covariances between assets and liabilities were then determined as the product of the correlation coefficient and the respective standard deviations for assets and liabilities.These positive covariances were entered into the quadratic program with negative signs to reflect their stabilizing effects.

The yield relationship for loans was based on a linear demand function for nonreal estate farm loans estimated by Barnard. The loan rate was specified as a function of loan volume and seven other exogenous variables; it was estimated from annual bank and market data for the 67 banks, cited earlier, over the 1973 to 1979 period.[5] For use in the risk program, the intercept term of the loan demand function was adjusted to reflect the products of the mean values of the other exogenous variables times their respective coefficients. This gave the expression $P_1 = A - \beta X_1$ where P_1 is the loan rate and X_1 is loan volume. The same demand function was used for nonagricultural loans in each model, except that the slope coefficient was reduced by 50 percent to represent different competitive characteristics.

Using least squares estimation introduces estimation as well as market risk in the estimated loan demand function (Klein and Bawa; Dixon and Barry). Consequently, cubic and quartic terms occur in the model's objective function, unless the slope coefficient for the loan demand function is assumed deterministic. This assumption seemed reasonable here since interest rate deregulation alone did not appear to alter the degrees of market concentration in banking.[6] To include both estimation and market risk, the equation for the loan demand function was solved by substituting values for all independent values except loan volume (see above). The effect of this procedure on estimation variance is accounted for by pre- and postmultiplying the variance-covariance matrix of the estimated coefficients by the mean value of the independent variables. Since the slope, β, is deterministic, then σ^2_β and $\sigma_{A,\beta}$ equal zero and only the variance of the intercept, σ^2_A appears in the matrix.

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[5] The estimated loan demand function was $P_1 = 8.024 - .076X_1$ after adjusting the intercept term to account for variables representing farm income, PCA loan rates, price support loan volume, bank competitors, inflation, and the exogenous securities rate. The results indicated a highly elastic function with four of the variables significant at the five percent level.

[6] This assumption may not hold in the future as savings and loan associations acquire more liberal asset authorities and as geographic restrictions on banking are liberalized.

Besides uncertainty about the unknown parameters, market risk must also be included. This occurs by combining the estimation risk (σ^2_A) for A (intercept term) and market risk for loans into one term. Moreover since the slope term (β) is multiplied by a squared term in the objective function, it is also added to market and estimation variance in order to collect all squared terms into a single term (γ). Thus, the following variance specifications were used for the two loan categories:

	Agr Loans (γ)	Non-Agr Loans (γ)
Forecast variance	5.31298	5.31298
Estimation variance	51.51262	51.51262
Slope coefficient	0.00075	0.00038
Total	56.82635	56.82598

To calculate covariances between loan yields and cost of liabilities, the standard deviation of the intercept (A) is measured as the square root of the sum of the variances for market and estimation error. The covariances in the base models were then the products of this standard deviation, the standard deviations for the cost coefficients, and the specified correlation coefficient of .2.

Model Results

The major focus of the model results is on the portfolio effects at each time period of parameter variations that represent managerial responses to the more volatile interest rate conditions of deregulation. However, it is helpful to briefly characterize the full set of risk-efficient solutions for each time point. Theoretically, one would expect an infinite number of trade-off values between risk and returns, with the bank's portfolio showing increased specialization in assets and funds acquisition as well as a larger scale of operations for higher risk-return solutions along the risk-efficient set. This indeed occurred, except a finite number of solutions resulted, due to a solution being identified with each change in the basis. The TP1 model had 19 risk-efficient solutions characterized by increasing levels of funds acquisition for the first 14 solutions, with a shift toward higher cost, higher risk sources until the funding limits were reached. Similarly, the allocation of funds in TP1 among the risky assets showed greater specialization among lending and investments for higher risk-return solutions. The income maximizing solution specialized in two activities (nontaxable securities and agricultural loans) due to their differing elasticities.

Similar solution patterns occurred in the models for TP2 (28 solutions) and TP3 (25 solutions). In addition, the risk-efficient sets for TP1 and TP2 intersected so that TP2 had greater risk efficiency for the higher risk-return solutions due mostly to the stabilizing effects of the positive covariances between the asset returns and the costs of rate-sensitive liabilities. In contrast, however, the risk-efficient set for TP3 shifted strongly toward higher variances for each expected value of the objective function and became much steeper due to the sharp increases in variance for the higher return solutions. These changes clearly reflected the additional rate-sensitive funding sources in the TP3 environment.

The selection of the risk-return trade-off value (λ) for equilibrium analysis was intended to provide consistency over the three time points. However, the wide range of λ values that occurred in each model precluded selecting a single value. For example, the middle value of λ (14,310) in the TP1 solutions was extremely low for the TP3 model. Similarly the middle value of λ in TP3 (294,976) was nearly the maximum value for TP2. Thus these two levels of λ were selected for equilibrium analysis in order to link together all three models and to use the middle values for TP1 and TP3. Both values were used in TP2 to represent two levels of λ during the transition period represented by TP2. The values selected are: λ+14,310 for TP1; λ+14,310 and λ=294,976 for TP2; and λ=294,976 for TP3. This compares the TP1 and TP2 results, and the TP2 and TP3 results, and thus roughly links the three periods.

Coordinating Nonloan Assets and Liabilities

From a bank's standpoint an improved coordination of nonloan assets and liabilities involves a closer matching of the maturities, rate patterns, and other characteristics for its securities and funds acquisition activities. This coordination is modeled by an increase in the correlation coefficient on nonloan returns and costs of rate-sensitive liabilities from the base value of .5 to an adjusted value of .8. This change should shift the risk-efficient solution toward greater risk efficiency and relatively greater holdings of nonloan assets, especially in the more volatile time periods, since these acquisitions would slow the rate of increase (or decrease) in portfolio risk as expected returns increase. The model solutions in general are consistent with these anticipated responses.

As shown in table 2, the stronger correlation between nonloan assets and liabilities has very little effect on portfolio composition in TP1 since few of the liabilities are rate-sensitive. The responses are stronger, however, in TP2 and TP3. As shown in tables 2 and 3 for the two levels of λ in TP2, the increase in correlation enables a greater scale of bank operation, higher expected income, reduced portfolio variance, relatively greater holdings of nonloan assets (primarily fed funds), and a minor reduction in loans relative to total assets, although absolute loan volume increased. These responses were relatively greater for the lower (more conservative) value of λ. The greater scale of operations was funded by additional time deposits and CDs since these sources had not reached limiting levels.

The TP3 solutions in table 3 indicate a similar pattern of response, although the magnitudes are greater, perhaps due to the smaller scale of operations in the base solution. Recall that λ=294,976 was a moderate level in TP3 and a much more liberal value in TP2. Implementing this scenario in TP3 resulted in an increased bank size by about 65 percent, higher expected income (31 percent), and higher portfolio variance (28 percent). Thus, variance relative to expected income declined. The higher risk efficiency mainly reflects a decline in the proportion of total loans to total assets from 81.2 percent to 49.2 percent. In general, these results show that the bank's performance will benefit from stronger coordination between nonloan assets and liabilities, although the relative importance of lending may decline.

Variable Rate Loan Pricing

The second type of equilibrium analysis involves the bank's portfolio responses to the formal adoption of variable loan rates. Similar to the coordination of nonloan assets and liabilities, variable rates represent a bank's attempt to stabilize its performance by achieving a higher correlation between the returns from lending and the costs of funds. Hence, variable rates are modeled by increasing the correlation coefficient between lending and funding from .2 in the base model to .5 in the variable rate scenario. In concept, variable rates might be perfectly positively correlated with costs of liabilities in order to completely remove interest rate risk; however, an increase in the correlation to a moderately high level of .5 seemed appropriate since banks seldom can reprice loans with the same frequency and precision as funding costs change (Barry and Calvert).

As with the preceding scenario, variable rates should reduce interest rate risks from lending and allow greater lending especially in the more volatile time periods. Offsetting effects may arise from a larger scale of operations and funding from sources with higher costs and variances. As table 2 indicates, the variable rate solution for TP1 compared to the base indicates a larger scale of operation (6.8 percent), moderate increases in lending (8.4 percent), higher expected income (2.5 percent), and a moderate increase in portfolio variance (eight percent). The responses are stronger for the same λ value in the more volatile TP2 model in which increases occur in total assets (34 percent), expected income (seven percent), and total lending (52 percent), while portfolio variance declines by 35 percent. A similar yet weaker response to variable rates occurred in TP2 as the λ value increased to 294,976, reflecting lower risk aversion. As table 3 shows, the variable rate scenario has greater lending and total assets, and reductions in expected income and variance. The stronger

Table 2. Results for the Base and Alternative Scenario Runs, TP1 and TP2 Models.[1]

	TP1 Model								TP2 Model							
	Base		Increase A/L Mgt.		Var. Rate Loan Price		Increased Loan Rate		Base		Increase A/L Mgt.		Var. Rate Loan Price		Increased Loan Rate	
λ	14,310		14,310		14,310		14,310		14,310		14,310		14,310		14,310	
Expected Income	151,003		150,408		154,690		197,745		194,016		206,028		207,639		350,627	
Quadratic X 10^6	427		423		394		732		737		410		480		1,223	
Quad. ÷ Exp. Inc.	2,830		2,813		2,545		3,702		3,800		1,989		2,310		3,488	
Assets:	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)
Fed. Funds Sold	132	1.5	59	0.7	275	3.1	425	3.8	0	0.0	796	8.6	224	2.3	0	0.0
1-Year T-Bills	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	0.1	0	0.0	0	0.0
Nontax. Sec.	3,911	47.5	896	48.3	4,007	45.5	5,122	46.3	2,834	39.6	3,314	35.7	2,904	30.3	2,830	30.5
Agr. Loans	1,948	23.7	912	23.8	2,092	23.8	2,550	23.2	2,001	27.9	2.387	25.7	2,979	31.1	3,028	32.6
Non-Agr. Loans	1,729	21.0	690	20.9	1,893	21.5	2,359	21.3	1,901	26.5	2,269	24.5	2,963	31.0	2,932	31.6
Reserves	516	6.3	511	6.3	533	6.1	601	5.4	426	6.0	497	5.4	504	5.3	488	5.3
Total Assets	8,236	100.0	8,068	100.0	8,800	100.0	11,057	100.0	7,163	100.0	9,269	100.0	9,574	100.0	9,278	100.0
Liabilities:																
Fed. Funds Pur.	100	1.2	100	1.2	100	1.1	100	0.9	0	0.0	0	0.0	0	0.0	0	0.0
Demand Dep.	5,000	60.7	5,000	62.0	5,000	56.8	5,000	45.2	4,000	55.8	4,000	43.2	4,000	41.8	4,000	43.1
Savings Dep.	2,825	34.3	2,868	35.6	3,000	34.1	3,000	27.2	2,700	37.7	2,700	29.1	2,700	28.2	2,700	29.1
Time Dep.	0	0.0	0	0.0	0	0.0	2,257	20.4	0	0.0	994	10.7	1,700	17.8	1,700	18.3
1-Year CD	211	2.6	0	0.0	600	6.8	600	5.4	385	5.4	1,200	12.9	928	9.7	314	3.4
6-Month CD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0.0	0	0.0	0	0.0	0	0.0
30-Month CD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0.0	275	3.0	146	1.5	464	5.0
Fed. Res. Borrow.	100	1.2	100	1.2	100	1.1	100	0.9	78	1.1	100	1.1	100	1.0	100	1.1
Total Liabilities	8,236	100.0	8,068	100.0	8,800	100.0	11,057	100.0	7,163	100.0	9,269	100.0	9,574	100.0	9,278	100.0

[1] The first column for assets and liabilities of each scenario is in $1,000 units and the second column is the percentage of total assets and total liabilities.

Table 3. Results for the Base and Alternative Scenario Runs, TP2 and TP3 Models.[1]

	TP2 Model									TP3 Model							
	Base		Increase A/L Mgt.		Var. Rate Loan Price		Increased Loan Rate			Base		Increase A/L Mgt.		Var. Rate Loan Price		Increased Loan Rate	
λ	294,976		294,976		294,976		294,976			294,976		294,976		294,976		294,976	
Expected Income	229,831		234,009		229,368		385,600			46,264		60,791		52,976		113,665	
Quadratic X 10^6	5,713		5,167		5,346		10,356			4,910		6,303		5,615		13,524	
Quad. ÷ Exp. Inc.	24,858		22,079		23,308		26,857			106,129		103,682		106,915		118,981	
Assets:	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)		($1,000)	(%)	($1,000)	(%)	($1,000)	(%)	($1,000)	(%)
Fed. Funds Sold	1,454	16.7	2,251	23.4	1,583	17.6	0	0.0		504	14.7	2,459	43.3	590	14.8	6	0.1
1-Year T-Bills	0	0.0	0	0.0	0	0.0	0	0.0		0	0.0	0	0.0	0	0.0	0	0.0
Nontax. Sec.	3,449	39.8	3,521	36.7	3,442	38.2	2,242	20.1		94	2.7	343	6.0	21	0.5	0	0.0
Agr. Loans	2,096	24.2	2,109	22.0	2,168	24.1	4,163	37.4		1,397	40.6	1,408	24.8	1,594	39.9	2,808	58.3
Non-Agr. Loans	1,202	13.9	1,209	12.6	1,327	14.7	4,178	37.5		1,395	40.6	1,394	24.5	1,735	43.4	1,928	40.1
Reserves	473	5.4	510	5.3	486	5.4	553	5.0		50	1.4	82	1.4	58	1.4	71	1.5
Total Assets	8,674	100.0	9,600	100.0	9,006	100.0	11,136	100.0		3,440	100.0	5,686	100.0	3,998	100.0	4,813	100.0
Liabilities:																	
Fed. Funds Pur.	0	0.0	0	0.0	0	0.0	0	0.0	Fund. Funds Pur.	0	0.0	100	1.8	0	0.0	0	0.0
Demand Dep.	4,000	46.1	4,000	41.7	4,000	44.4	4,000	35.9	Trans. Acc't.	0	0.0	0	0.0	0	0.0	0	0.0
Savings Dep.	2,700	31.1	2,700	28.1	2,700	30.0	2,700	24.2	Deposit 1	0	0.0	386	6.7	0	0.0	0	0.0
Time Dep.	1,700	19.6	1,700	17.7	1,700	18.9	1,700	15.3	Deposit 2	0	0.0	1,700	29.9	498	12.5	1,313	27.3
1-Year CD	274	3.2	1,200	12.5	606	6.7	1,200	10.8	Deposit 3	1,640	47.7	1,700	29.9	1,700	42.5	1,700	35.3
6-Month CD	0	0.0	0	0.0	0	0.0	936	8.4	Deposit 4	1,700	49.4	1,700	29.9	1,700	42.5	1,700	35.3
30-Month CD	0	0.0	0	0.0	0	0.0	500	4.5	Fed. Res. Borrow.	100	2.9	100	1.8	100	2.5	100	2.1
Fed. Res. Borrow.	0	0.0	0	0.0	0	0.0	100	0.9	FICB Borrow.	0	0.0	0	0.0	0	0.0	0	0.0
Total Liabilities	8,674	100.0	9,600	100.0	9,006	100.0	11,136	100.0		3,440	100.0	5,686	100.0	3,998	100.0	4,813	100.0

[1] The first column for assets and liabilities of each scenario is in $1,000 units and the second column is the percentage of total assets and total liabilities.

variance decline indicates a gain in risk efficiency.

The TP3 responses to variable rates were weaker overall, although the high λ value in TP3 yields a much more conservative portfolio than in TP2. As table 3 shows, the variable rate scenario yields about the same increases in expected income (14 percent) and variance (14 percent), and moderate increases in total lending (19 percent) and total assets (16 percent). These TP3 responses were more moderate than in the previous scenario despite the same increase in correlation between nonloan assets and funding. The more moderate responses may reflect the dampening effects of the downward sloping loan demand curves, and the effects of individual variances.

Increased Loan Interest Rates

The third type of equilibrium analysis involves the bank's portfolio responses to raising its loan rates in order to offset the increased interest rate risk involved with lending. Variable rate loan pricing is also included in this scenario, since the two responses would likely occur together. Increased interest rates on loans are modeled by increasing the intercept term of the estimated demand equation to reflect the average rate charged for operating loans in the Chicago Federal Reserve District in 1977 and 1980 for TP1 and TP2, with the TP2 rate also used in TP3.

Increased loan rates should increase the risk efficiency of lending, and thus allow greater lending and a larger scale of operations. Offsetting effects on income may arise from the larger scale of operation and funding from sources with higher costs and variances. As table 2 indicates, the increased loan rate solution for TP1 compared to the base has a larger scale of operation (34.3 percent), greater lending (33.5 percent), higher expected income (31 percent), and a greater increase in portfolio variance (71.4 percent). The responses for the same λ value in the more volatile TP2 model indicate an increase in total assets (29.5 percent), but stronger increases in total lending (52.7 percent), portfolio variance (65.9 percent), and expected income (80.7 percent). A similar response to increased loan rates occurred in TP2 as the λ value increased to 294,976. As table 3 shows, the increased loan rate scenario has slightly greater total assets (28. percent), moderate increases in expected income (67.8 percent) and portfolio varianc (81.3 percent), and a much greater increase in total lending (152.9 percent). Along with slight decrease in nontaxable securities (35 percent), these results reflect a shift to the more risk-efficient loans.

The TP3 responses to higher loan rates were weaker in terms of total operations and lending, although the high λ value in TP3 yields a much more conservative portfolio than in TP2. However, the responses are much stronger for expected income and portfolio variance. As table 3 shows, the increased loan rates yield an increase in tota assets (39.9 percent), a moderate increase in total lending (69.6 percent), and much greater increases in expected income (145.7 percent) and portfolio variance (175.4 percent). The strong responses for expected income and portfolio variance may reflect the increasing importance of customer loan pricing and profitability in a more volatile interest rate environment.

Implications and Concluding Comments

The relative changes in the risk-efficient sets evaluated here clearly demonstrate how interest rate deregulation is affecting the risk position of small rural banks. To cope with a riskier environment, these banks must either accept the greater portfolio risks, adopt more conservative portfolios, or more rigorously manage interest rate risks. The management methods evaluated here included (a) stronger coordination between nonloan activities and funds acquisition, (b) variable rate pricing, and (c) increased interest rates on loans. The model results indicated that each method can contribute effectively to the portfolio adjustment process with the effects increasing as the volatilities from deregulation increase. Thus, those smaller banks that adopt one or more of these methods (and perhaps other methods) should exhibit stronger lending performance for their agricultural borrowers, compared to other small banks that may curtail lending activities.

One approach to validating the model results is by comparing them with the banks' actual performance. Since interest rate deregulation was only completed in 1984, insufficient time has passed to accumulate data for a comprehensive analysis. Moreover, the effects of economic recession, recovery, farm financial stress, and other factors occurring in the early 1980s have also influenced bank performance. Nonetheless, several observations can be noted, especially for variable rate pricing. Agricultural banks appear to have greatly increased their capacity to reprice loans through formal adoption of variable rates and adjustment of loan maturities. The Federal Reserve System's survey of terms of bank lending, started in 1977, indicates that the percentage of farm loans made by banks with variable rates increased from a low of 13.2 percent in May 1977 to a high of 53.5 percent in May 1983; in addition, the use of variable rates tended to be greater on larger loans and with larger banks. Similar results from a national survey indicated that 37.6 percent of agricultural banks in mid-1981 had adopted a variable rate policy for farm loans and that 46.9 percent of the banks would vary the loan maturity in loan pricing (Barry and Calvert). The use of variable rates increased significantly as bank size increased and was more common in branching and multibank holding company systems.

Little factual evidence is available about rural banks' use of other methods of responding to nterest rate risk, although general mpressions are that these banks have placed much emphasis on asset/liability management as a response to interest rate deregulation and other sources of uncertainty. Moreover, several other general developments have occurred. First, the iquidity positions of agricultural banks mproved considerably since 1980 due to stronger deposit growth and slowdowns in oan demand, especially from financially stressed agricultural borrowers. In addition, he wide spread in interest rates on farm oans that occurred between agricultural banks and the Farm Credit System narrowed considerably following 1981 as market nterest rates declined and stabilized. Nonetheless, rates have stayed far above historic levels. Finally, profitability measures ndicate that agricultural banks continued to achieve relatively strong performance in the early 1980s during the initial stages of deregulation. Rates of return on banks' equity capital in 1982 were only slightly less than during 1979 to 1981, and still in line with earnings rates during most of the 1970s (Melichar; Barry, 1984). Following 1982, however, the rates of return to equity declined sharply for these banks due primarily to higher loan losses. These higher loss rates and other costs of administering loans in part reflect the difficulties farmers and other borrowers have in dealing with higher, more volatile interest rates. Thus, while not considered in the modeling analysis, these interest rate effects from deregulation likely added to borrowers' financial problems and increased the banks' lending risks as well.

The modeling approach used here proved effective in reflecting the general financial environment, market characteristics, and risk position of an individual bank. Moreover, the approach extended other empirical analyses by jointly considering the effects of uncertainty and imperfect loan markets. However, the analysis did not explicitly consider the bank's competitive position in its local market relative to the possible responses of other banks and nonbank financial institutions. Hence an extension of the analysis to include flows of funds within the local market and among markets would be useful (Boehlje, et. al.). Also, extending the micro analysis to consider the effects of geographic liberalization, expanded product authorizations, and other regulatory changes would be timely and useful since these issues will continue to impact heavily on small rural banks.

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